TECHNICAL MANUAL

(890-0001-000)

REPRODUCERS

SP SERIES

MONO, SINGLE CUE	826-0001-000
STEREO, SINGLE CUE	826-0002-000
MONO, THREE CUE	826-0003-000
STEREO, THREE CUE	826-0004-000
MONO, HI-SPEED CUE	826-0005-000
STEREO, HI-SPEED CUE	826-0006-000

WP SERIES

MONO, SINGLE CUE	826-0011-000
STEREO, SINGLE CUE	826-0012-000
MONO, THREE CUE	826-0013-000
STEREO, THREE CUE	826-0014-000
MONO, HI-SPEED CUE	826-0015-000
STEREO, HI-SPEED CUE	826-0016-000

© **Copyright 1975 International Tapetronics Corporation.**
Made under one or more of the following patents:
3, 800, 323 3, 801, 043 3, 801, 329 3, 833, 925 3, 865, 719
other patents pending

PAGE

SECTION I INTRODUCTION

A. General description 1-1
B. Specifications 1-1

SECTION II INSTALLATION AND OPERATION

A. Unpacking 2-1
B. Installation 2-1
C. External connections—audio 2-1
D. External connections—control 2-1
E. Controls and indicators 2-1
F. Motor on-off control switch 2-2
G. Operating procedures 2-2

SECTION III PRINCIPLES OF MECHANICAL OPERATION

A. Head assembly 3-1
B. Capstan drive 3-1
C. Pressure roller linkage 3-1

SECTION IV MECHANICAL ADJUSTMENTS

A. General mechanical information 4-1
B. Capstan shaft (motor) position 4-1
C. Pressure roller/capstan pressure-coarse solenoid adjustment 4-1
D. Pressure roller/capstan pressure-fine solenoid adjustment 4-2
E. Solenoid damping 4-2
F. Right cartridge guide 4-2
G. Left cartridge guide 4-2
H. Tape guide adjustment 4-3
I. Head height adjustment 4-3
J. Cartridge corner post adjustment 4-4
K. Monophonic head azimuth adjustment 4-4
L. Stereo system head azimuth adjustment 4-5
M. Head replacement 4-7

SECTION V MECHANICAL DRAWINGS

Top view ..... Fig. 5-1 5-1
Front view ..... Fig. 5-2 5-1
Rear view ..... Fig. 5-3 5-2
Bottom view ..... Fig. 5-4 5-2
Deck assembly, exploded view ..... Fig. 5-5 5-3
Track locations ..... Fig. 5-6 5-3
Capstan shaft locator gauge ..... Fig. 5-7 5-4
Capstan shaft location ..... Fig. 5-8 5-4
Linkage chain—pin location ..... Fig. 5-9 5-4
Solenoid plunger—clevis position ..... Fig. 5-10 5-4
Pressure roller shaft location ..... Fig. 5-11 5-5
Pressure roller—capstan pressure ..... Fig. 5-12 5-5
Tape guide position ..... Fig. 5-13 5-5
Head zenith adjustment ..... Fig. 5-14 5-5
Head height adjustment ..... Fig. 5-15 5-6
Cartridge corner post positioning ..... Fig. 5-16 5-6

SECTION VI MECHANICAL PARTS LIST 6-1

SECTION VII PRINCIPLES OF ELECTRICAL OPERATION

A. General information 7-1
B. Solenoid power supply 7-1
C. Low voltage power supply 7-1
D. Control Circuitry 7-1
E. Cue Circuitry 7-2
F. Program Play Circuitry 7-2
G. High Speed Cue Circuitry 7-3

SECTION VIII ELECTRICAL ADJUSTMENTS

A. Controls 8-1

SECTION IX TEST CARTRIDGES AND USES

A. Preventive maintenance 9-1
B. Test cartridges 9-1
C. Use of Test Cartridges 9-1

SECTION X ELECTRICAL DRAWINGS

Sample remote control schematic ..... Fig. 10-1 10-1
Program amplifier card parts location ..... Fig. 10-2 10-2
Cue detector card parts location ..... Fig. 10-3 10-3
Hi-speed cue detector card ..... Fig. 10-4 10-4
Utility circuit board parts location ..... Fig. 10-5 10-4

SECTION XI ELECTRICAL PARTS LIST

A. Chassis 11-2
B. Utility board—SP series 11-2
C. Utility board—WP series 11-2
D. Program reproduce amplifier card 11-2
E. Cue tone detector card 11-3
F. Hi-speed cue detector card 11-4

SECTION XII MAINTENANCE SCHEDULE

A. General 12-1
B. Mechanical maintenance—reproducers 12-1
C. Mechanical maintenance—recorders 12-1
D. Electrical maintenance—reproducers 12-1
E. Electrical maintenance—recorders 12-1

SECTION XIII WARRANTY

SECTION XIV ELECTRICAL SCHEMATICS

SP-WP Reproducers
SP-WP Reproducers with Hi-Speed Cue

A. GENERAL DESCRIPTION

International Tapetronics Corporation's magnetic cartridge tape Reproducers are designed to meet or exceed the NAB standards for cartridge tape recording and reproducing. The SP & WP series Reproducers are available in either monophonic or stereophonic configurations. All reproducers are furnished with primary (1 kHz) cue capabilities while the secondary (150 Hz) and tertiary (8 kHz) cue detectors are optional. Also optional is the Hi-Speed Cue feature which permits the rapid advance of the tape to the next cue tone.

The SP series is designed to function exclusively as a reproducer and accepts both the NAB type A and NAB type B cartridges. The WP series accepts the NAB types A, B and C cartridges and can be used alone as a Reproducer or with a RA series Recording Amplifier. The RP series combines these two units on a single front panel.

The printed circuit electronics include the latest silicon solid-state diodes, transistors, and integrated circuits. The regulated power supply is an integrated circuit in a plug-in TO-3 case. The program amplifiers have NAB equalization and transformer coupled outputs.

The cue tone detectors utilize reliable L-C networks and provide relay contact output information. Upon the conclusion of the audio, the Reproducer continues to advance the tape until a 1 kHz primary cue tone is detected, whereupon the 1 kHz cue detector stops the tape drive mechanism.

The Secondary Cue Tone (150 Hz) Detector, when the machine is so equipped, can be used for such functions as the indication of the "end-of-message." This is necessary in automated systems to start the next machine and can be useful in live operations to keep the operator "on cue" for inserts, tags, or the beginning of the next material. The presence of the secondary cue tone is indicated by the brightening of the front panel and remote "Run" (Start) Lamp.

In machines with the Hi-Speed Cue option, detection of the 150 Hz cue tone automatically places the Reproducer in the "fast run" mode and advances the tape to the next cue tone at four times the normal speed.

The Tertiary Cue Tone (8 kHz) Detector, also optional, can be used to supply information in automated systems or for auxiliary switching such as the control of slide projectors in television. Presence of the tertiary cue tone is indicated by the illumination of the front panel and remote "Ready" (Stop) Lamps.

A full-swing pressure roller is connected to the actuating solenoid by a mechanically simple chain linkage with a screw adjustment for pressure roller/capstan pressure. Air damping of the solenoid is adjustable with a needle valve. The direct-capstan, 450 RPM (375 RPM in 50 Hz models), hysteresis synchronous drive motor with an electrolyzed shaft provides optimum tape drive. A 450/1800 RPM (375/1500 in 50 Hz models) is used in units with the Hi-Speed Cue feature.

The precision head assembly consists of three independent tape guides and micro-adjust head mounting blocks with screw adjustments for height, zenith, and azimuth.

Several other features improve the ease and reliability of operation and serviceability. The ITC Reproducer is fully operative when partially or fully removed from its slide-out case to facilitate cleaning, maintenance and adjustment. Locking connectors are supplied for audio output and remote control. Socket connectors for head cables provide plug-in connection at the head and at the cue tone and audio amplifiers.

The head and track configuration of ITC Reproducers is in accordance with the NAB Standards. The magnetic tape head nearest the capstan shaft is head A, the reproducing head. Head B is a "dummy" which is installed to maintain constant tension on the tape, minimize wow and flutter and tape skew. On the WP series head B is a recording head when the Reproducer is connected to a RA series recording Amplifier.

On mono machines, the upper track is the program channel and the lower track is the cue channel. On stereo units, the upper track is the left program channel, the center track is the right program channel, and the lower track is the cue channel. A graphic comparison of the mono and stereo track configuration is shown in Figure 5-6.

B. SPECIFICATIONS

Power:	117 volts AC, 60 Hz, 70 watts; other voltage and frequency variations are available on special order.
Tape Speed:	7½ inches per second; direct drive, hysteresis-synchronous, capstan motor with electrolyzed shaft and instrument-type, permanently lubricated ball bearings.

Wow and Flutter:		0.2% or less, NAB Un-weighted.
Timing Accuracy:		0.1% or better
Audio Output:		+12 dBm before clipping; normally +4 dBm: 600 ohms balanced. May be strapped for 150 ohms.
Distortion:		2% or less, record to playback at O VU record level, 400 Hz.
Noise:		55 dB or better below reference of 400 Hz at 3% THD, monophonic. 50 dB or better below reference of 400 Hz at 3% THD, stereophonic.
Cross Talk Between Channels:		Better than 50 dB at 1 kHz
Frequency Response:		±2 dB from 50 to 15,000 Hz
Equalization:		NAB. Adjustable to compensate for head wear.
Cue Signals:		NAB primary cue, 1 kHz, standard. Secondary cue, 150 Hz, and tertiary cue, 8 kHz, optional. External information when tone is sensed furnished as relay contact closure.
Playback Time:	SP Series:	2 seconds to 16 minutes, NAB size A and B cartridges.
	WP Series:	2 seconds to 31 minutes, NAB size A, B, and C cartridges.
Start Time:		0.1 second, at minimum solenoid damping.
Stop Time:		0.1 second, at minimum solenoid damping.
Ambient Temperature:		55 degrees C, 131 degrees F, maximum
Remote Control:		All controls and indicators
Mounting:		Table top mounting with rack mounting adapters optional
Dimensions:	SP Series:	8½" width, 5¼" height (add 3/8" for feet), 11" depth.
	WP Series:	17¼" width, 5¼" height (add 3/8" for feet), 11" depth.
Weight:	SP Series:	23 pounds
	WP Series:	28 pounds
Head Configuration:		NAB (provided with reproduce and dummy head only; except WP Series supplied with recording head when purchased with an RA Series Recording Amplifier)

A. UNPACKING

Remove the reproducer from the shipping carton and inspect the unit for damage. All packing material must be retained if a claim for shipping damage is to be filed; and, therefore, should be kept on hand until installation has been completed in case concealed damage is discovered. If shipping damage is found, contact ITC for assistance in the filing of claims.

B. INSTALLATION

The ITC Reproducers are supplied in cases prepared for table top mounting. Adapter angle brackets, hardware and instructions for mounting in a 19 inch rack are supplied as an option.

To provide adequate ventilation in rack installations, vertical spacing between Reproducers and other equipment should be from 1¾" to 3½" depending on the temperature inside the closed rack.

C. EXTERNAL CONNECTIONS–AUDIO

Audio output connections are made on the six pin socket J2. The mating plug is supplied. Terminal information is provided below.

CONNECTOR J-2

Terminal	Function
1	Monophonic Shield (Ground) (left channel stereo)
3	Monophonic Audio Output (left channel stereo +)
5	Monophonic Audio Output (left channel stereo –)
2	Right Channel Stereo Shield (Ground)
4	Right Channel Stereo Audio Output (+)
6	Right Channel Stereo Audio Output (–)

Socket and terminal locations are shown in Section V, Figure 5-3.

The impedance of the audio output is normally 600 ohms. A 150 ohm output can be achieved by changing the transformer wires on connector J2 as noted on the schematic diagram.

In stereophonic systems, proper phasing of the audio connections must be observed.

D. EXTERNAL CONNECTIONS–CONTROL

Remote Control connections are provided on the fifteen pin socket J1. A mating plug is supplied for this purpose and terminal information is provided as follows:

CONNECTOR J-1

Terminal	Function
1	Ground
2	Remote Start (Run Ground)–Normally Open Switch
3	Remote Start (Ready Ground)–Normally Open Switch
4	Remote Stop (Ready Ground)–Normally Open Switch
5	Remote Stop (Stop Ground)–Normally Open Switch
6	Remote Run Lamp Ground Circuit
7	Remote Ready Lamp Ground Circuit
8	+24 Volts
9-10	Sec. Cue Relay (Normally Closed)
10-11	Secondary Cue Relay Contact (Normally Open)
12-13	Tertiary Cue Relay Contacts (Normally Open)
14-15	Cue Audio–Unbalanced Audio Output from Cue Preamplifier; High Impedance (Terminate with 10K ohms or greater)

Socket and terminal locations are shown in Section V, Figure 5-3.

Ground switching is employed for all remote control functions. Normally open, momentary action switches are utilized for both the remote START and STOP functions. A sample remote control schematic is shown in Figure 10-1.

If necessary, the normally open stop circuit can be replaced with a normally closed circuit by removing the jumper installed inside the machine between pins 3 and 4 on J1 and installing a remote, normally closed switch in its place.

E. CONTROLS AND INDICATORS

Each of the Reproducers (SP/WP) have the following associated control switches and indicators:

POWER LAMP — The Power Indicator Lamp shows that the Reproducer is connected to an AC power source. (Should a power switch be required, the Power Indicator Lamp may be replaced with a switch as shown on the schematic diagram.)

CARTRIDGE SWITCH — Two cartridge-sensing Micro Switches are installed on all single deck cartridge machines. These switches are designated as S1 in Figure 5-1. The switch located nearest the deck may be used as an on/off switch for the capstan motor. As supplied from the

factory, a strap across the switch places the motor in the "Run" mode when source voltage is applied to the Reproducer. The removal of the strap will place the motor in the "Run" mode only when a cartridge is placed in the Reproducer.

The Micro Switch located furthest from the deck provides a "Ready" indication to the Reproducer's control circuit and illuminates the indicator lamp located in the Stop Switch (on front panel) when a cartridge is placed in the Reproducer. The "Ready" cartridge switch must be operated in order for the tape transport to be started.

START SWITCH — The Start Switch (green) is used to energize the transport's pressure roller solenoid and put the tape in motion. The indicator lamp in the Start Switch shows that the machine is in a "Run" condition. Location is shown in Figure 5-2.

STOP SWITCH — The Stop Switch (yellow) can be pressed to stop the tape drive system. (Remember that unless a cartridge stops automatically, it will not be properly cued for the next play.) The indicator lamp in the Stop Switch shows that a cartridge has been properly loaded and the machine is "Ready" to be started.

F. MOTOR ON-OFF CONTROL SWITCH

Two cartridge-sensing micro switches are installed on all machines. The switch located nearest the deck, when utilized, will serve as an on/off switch for the capstan motor.

It is the customer's option as to whether this switch is actually used. As supplied from the factory, a strap across the switch negates the action of the switch and causes the motor to run continuously (as long as AC is applied to the machine). This mode of operation would be recommended for most installations. The motor is designed for continuous duty operation, and the instrumentation-type bearings in the motor will last longer if they are not subjected to the stresses of frequent expansion and contraction caused by starting and stopping the motor. Having the motor run continuously offers a second advantage in that a cartridge can be started instantly after being placed in the machine without having to wait the few seconds it takes for the motor to come up to speed.

In those installations where the cartridge machine is not frequently used, or where the machine builds up substantial heat because of poor ventilation or high ambient temperature, it may be desirable to allow the motor to remain off when a cartridge is not in place. This may be accomplished by removing the strap that is across the terminals of the motor control micro switch. (Refer to the schematic.)

NOTE: It is normal for a frequently used machine to feel quite warm to touch. Both the motor and the solenoid will generate heat when frequently or continuously used. This is normal and represents a problem only if the machine receives little or no ventilation or the ambient temperature is quite high.

G. OPERATING PROCEDURES

To play a tape cartridge:

1. Insert a properly recorded tape cartridge into the right-hand side of the cartridge slot.
2. Check to see that the Ready Lamp (Stop Switch) is illuminated, indicating that the cartridge has been properly inserted and that the Reproducer is "Ready" for operation.
3. Press the Start Switch momentarily. The tape drive system will be started, and the tape motion will continue until the primary (1 kHz) cue tone automatically stops the machine or until the Stop Switch is pressed.

A. HEAD ASSEMBLY

The micro-adjust head assembly used on SP and WP Reproducers includes three tape guides constructed of non-magnetic material. The positioning of these tape guides is pre-set at the factory, but may be field adjusted if required. The head mounting bracket is of very sturdy contruction with the azimuth pivot point located directly behind the center of the heads in both a vertical and horizontal plane. This feature permits azimuth adjustment without disturbing the zenith adjustment. The head assembly includes the provision for locking each head in position after adjustment, and the head mounting arrangement permits rapid head replacement when required.

Reliability, maintenance and performance is improved through the use of heads with a metal face and a hyperbolic front contour. The shape and material reduce the need for cleaning and relieve the problems sometimes caused by pressure pads.

B. CAPSTAN DRIVE

The proper drive of tape in a cartridge is much more difficult than in reel and other types of tape equipment. SP and WP Reproducers are designed and constructed to overcome the difficulties of cartridge tape drive. In a cartridge, the tape pulls from the center and winds back on the outside of an endless loop of tape. Therefore, the tape must slip upon itself as the cartridge plays. This slipping action does not occur at an even rate, and the tape tends to jerk as it pulls from the center of the hub. In addition, the tape is coated with a lubricant which reduces drive friction. One means of improving the drive would be to use a larger diameter pressure roller, but this is not possible since there is insufficient clearance in the bottom of the cartridge for a larger roller. Another approach—the one used in ITC equipment—is to use a capstan shaft with the largest diameter possible. This results in the use of a 450 RPM (375 RPM in 50 Hz models) direct-drive capstan motor with an electrolyzed shaft. The hysteresis-synchronous, direct-drive motor has a constant speed since there are no belts or pulleys to introduce speed variables.

With a large capstan, directly driven, constant tape drive can be achieved if the tape is not permitted to slip between the pressure roller and the capstan. This problem is counteracted by machining the capstan shaft to a very high polish and then blasting it with aluminum oxide particles. The result is a finish with a random-rough pattern which provides the positive tape drive demanded of professional cartridge machines. An electrolyzing process hardens the roughened pattern and prevents the finish from wearing. The life of the shaft finish should be approximately five years.

C. PRESSURE ROLLER LINKAGE

A chain and sprocket converts the reciprocating action of a powerful solenoid into the rotating action required to bring the pressure roller into contact with the capstan. This design is both reliable and efficient and provides more than adequate torque. Greater turning torque must be exerted as the pressure roller comes into contact with the capstan, and the required torque curve is achieved through proper shaping of the solenoid plunger. Correct pressure roller/capstan pressure is achieved by adjusting the screw which attaches the chain assembly to the solenoid plunger. This mechanical assembly has a design life in excess of a million operations.

Extremely quiet mechanical operation is achieved through the use of an air-damped solenoid. The speed and the resultant noise of the assembly is controlled by a needle valve at the rear of the solenoid.

The design of the SP and WP Series Reproducers results in long life, dependable operation, and a minimum of maintenance.

A. GENERAL MECHANICAL INFORMATION

ITC Tape Cartridge Reproducers have been designed to provide reliable, rugged mechanics which require a minimum of simplified adjustments.

The sequence in which mechanical adjustments are completed, however, is important. Therefore, if a complete check of all mechanical adjustments is required, start at the beginning of this section and check and/or adjust the deck as instructed—from Capstan Shaft (Motor) Position to Head Azimuth Adjustment.

Head Adjustments, outlined last in this section, may be made without having completed the deck adjustments covered first in this section.

The alignment gauges mentioned in this section are optionally available from ITC.

B. CAPSTAN SHAFT (MOTOR) POSITION

While the adjustment procedure outlined below will normally be required only if the motor has been removed, a check for proper positioning of the capstan should be part of the regular maintenance schedule.

1. Remove the rubber pressure roller and place the round steel Capstan Shaft Locator Gauge on the pressure roller shaft of the deck as shown in Figure 5-7.
2. Loosen the motor mounting screws and manually press the steel Capstan Shaft Locator Gauge against the capstan shaft.
3. While squeezing the steel gauge and the capstan shaft together, position the capstan shaft as shown in Figure 5-8. The steel tool must lie flat against the capstan shaft to make the pressure roller shaft parallel with the capstan shaft.

   The slight offset between the two shafts allows the tape to come into contact with the capstan shaft before the pressure roller to minimize wow and flutter and to slightly "wrap" around the capstan shaft for better pull.
4. Tighten the motor mounting screws and re-check the adjustment.
5. Replace the rubber pressure roller on its shaft. The steel washer goes on the bottom and the nylon washer goes on the top just under the retainer clip.

C. PRESSURE ROLLER/CAPSTAN PRESSURE —COARSE SOLENOID ADJUSTMENT

This adjustment is made at the factory and should not normally have to be repeated unless a parts replacement (solenoid, solenoid plunger, linkage chain, clevis, or cross-shaft clamp) has been made in the solenoid linkage assembly. If there is no specific reason for making this adjustment, skip ahead to part "D" of Section IV.

1. Check to see that the steel roll pin protruding from the cross-shaft clamp is inserted between the eleventh and twelfth (counting from the clevis) connector pins in the linkage chain as shown in Figure 5-9.
2. Loosen the clevis locknut and rotate the solenoid plunger and the locknut until the Pressure Roller Compression Tool will fit snugly between the shoulder of the clevis and the locknut as shown in Figure 5-10. The locknut must be finger tight against the plunger. If the tool is not available, the space between the clevis and the locknut should be .2812 (9/32) inch.
3. Remove the capstan motor plug from the socket and actuate the cartridge sensing micro switch by pushing a piece of folded cardboard or other material between the switch's actuator arm and plunger (Figure 5-1).
4. Press the front panel START switch to energize the solenoid; loosen the screws in the cross-shaft clamp (Figure 5-1). Adjust the clamp screws so that the clamp is snug on the shaft but can be moved with a small amount of force.
5. Remove the rubber pressure roller and adjust the pressure roller shaft so that the Pressure Roller Compression Gauge fits snugly between the left side of the slot in the deck and the pressure roller shaft as shown in Figure 5-11.
6. Place the steel Capstan Shaft Locator Gauge on the pressure roller shaft, press it tight against the capstan shaft (see Figure 5-7), and tighten the screws in the cross-shaft clamp. If the Capstan Locator Gauge is not available, place a rubber pressure roller on the shaft, press it against the capstan until the rubber is depressed approximately 1/32 of an inch where it makes contact with the capstan shaft, and tighten the screws in the cross-shaft clamp. Pressure is applied by pushing plunger into solenoid, this will keep this linkage taut.
7. Remove the Capstan Shaft Locator Gauge and check the adjustment made in Step 5 above.
8. Replace the rubber pressure roller on its

shaft. The steel washer goes on the bottom and the nylon washer goes on the top just under the retainer clip.

9. Replace the capstan motor plug in the socket.

D. PRESSURE ROLLER/CAPSTAN PRESSURE –FINE SOLENOID ADJUSTMENT

This adjustment will normally be required only after parts replacement; but for best results, a check of the pressure roller/capstan pressure should be on the routine maintenance schedule.

1. Using the Pressure Roller Compression Gauge, check the distance between the capstan shaft and the pressure roller shaft. The tool should advance to the first "step" and stop as shown in Figure 5-12.
2. If adjustment is required, loosen the clevis locknut and rotate the solenoid plunger as follows (Figure 5-1):
   a. To increase the pressure, rotate the solenoid plunger so that it penetrates deeper into the solenoid (clockwise as viewed from the front panel). This will increase the pull of the solenoid on the plunger and, therefore, the pressure roller/capstan pressure will be increased. The plunger must not "bottom out" to the seat of the solenoid.
   b. To decrease the pressure, rotate the plunger counterclockwise as viewed from the front panel.
3. Tighten the clevis locknut when the proper pressure has been achieved. (If proper adjustment cannot be attained, complete the coarse adjustment outlined in part "C" of Section IV before repeating the fine adjustment.)

E. SOLENOID DAMPING

The air damping of the solenoid is controlled by the adjustment of the set screw at the rear end of the solenoid seat. The speed of the solenoid operation is proportional to the speed at which air is allowed to move through the small hole on the underside of the solenoid seat. The noise of the solenoid operation shares the same relationship.

The adjustment procedure outlined below in no way affects pressure roller/capstan pressure as in some machines of older design. See Figure 5-1 for parts location.

1. Loosen the locknut on the Solenoid Damping Set Screw.
2. Turn the Damping Screw clockwise to reduce, or counterclockwise to increase, the speed of the solenoid operation. The average length of time for the solenoid to retract is 0.1 sec.
3. Check the adjustment by inserting a cartridge and starting the Reproducer. Repeat the adjustment as required.
4. Tighten the locknut.

F. RIGHT CARTRIDGE GUIDE

The right cartridge guide controls the cartridge positioning in relation to the heads, capstan shaft, and pressure roller shaft. Proper location of this cartridge guide is essential to proper operation of the machine. The right cartridge guide is properly positioned at the factory and should not normally require adjustment.

The adjustment procedure is outlined below:

1. Loosen the right cartridge guide mounting screws and insert a cartridge into the deck.
2. Adjust the cartridge so that the pressure roller shaft is centered in the "keyhole" in the cartridge.
3. Position the cartridge guide 1/64 of an inch from the cartridge and at a right angle with the front edge of the deck.
4. Tighten the cartridge guide mounting screws.
5. Press the start switch and, with the cartridge playing, check to see that the cartridge is free to move approximately 1/64 of an inch in and out and from left to right. If the cartridge is tight in the machine, re-check all mechanical adjustments.

G. LEFT CARTRIDGE GUIDE

The left cartridge guide is intended to help guide the cartridge into the machine and prevent damage to a head due to improper loading. When NAB type B (or C in the WP Series) cartridges are used, the left cartridge guide must be removed.

The adjustment procedure is outlined below:

1. With a cartridge in the machine, position the end of the left cartridge guide nearest the front panel approximately 1/8 of an inch from the cartridge and snug down the mounting screw nearest the front panel.
2. Position the end of the left cartridge guide nearest the head assembly approximately 1/32 of an inch from the cartridge.
3. Tighten both mounting screws.

The left cartridge guide should not come into contact with the cartridge when the cartridge has been properly inserted into the machine. Its purpose is to simply guide the cartridge into place — not to hold it there.

H. TAPE GUIDE ADJUSTMENT

The Reproducer has three independent tape guides to provide the maximum of tape guidance outside of the cartridge. The left tape guide has been specially formed to provide clearance for the corner post in the cartridge.

For optimum performance, not only should a check for proper tape guide positioning be made, as outlined below; but, also the positioning of the corner post in the cartridges should be checked and adjusted as shown in Figure 5-16.

The adjustment procedure is outlined below:

1. Check the positioning of each tape guide by advancing the Tape Height Gauge into the tape guide as shown in Figure 5-13. The gauge should advance fully into the tape guide, without friction, while resting flat on the deck—not tilted as shown by the dashed line (or its opposite) in Figure 5-13. The tape height gauge should be demagnetized so that it will not effect the "heads."
2. If adjustment is required, loosen the two tape guide mounting screws.
3. Keeping the Tape Height Gauge flat on the deck, position the tape guide as shown in Figure 5-13.
   a. Keep the tape guides as close to the head as possible without coming into contact with the head mounting blocks or any parts mounted on these blocks.
   b. Keep the tape guides vertical. Normally, the bottom edge of the tape guide's mounting surface should rest on or very near the surface of the deck plate.
4. Tighten the tape guide mounting screws and re-check the adjustment.
5. Check and adjust as required the other tape guides.

The slot in the tape guide is .249 inch wide. (Actual tape width is .246± .002 inch.) The width of this slot can also be properly gauged with the Tape Height Gauge. The arm on the gauge should advance fully into the slot without friction, but there should be no room for noticeable movement of the tool in the slot.

Adjustments obtained with the Tape Height Gauge should be accurate to less than .001 of an inch—much better than that obtained with most inexpensive optical devices.

I. HEAD HEIGHT ADJUSTMENT

The magnetic tape head nearest the capstan shaft is head A, the reproducing head. Head B in the SP series and independent WP series is a "dummy" which is installed to maintain constant tension on the tape and minimize wow and flutter. On the WP series, head B is a recording head when the Reproducer is connected to a RA series Recording Amplifier.

The adjustment procedure outlined below should be followed in positioning both the reproducing and recording heads. Only coarse height and zenith adjustments are required for a "dummy" head when used in position B. See Figure 5-1 for the location of the adjustment screws.

1. Loosen the Lock Screw L by turning it counterclockwise approximately four complete turns.
2. Course Height: Adjust the Front Height Screw FH until the top of the upper head track (pole piece) is 9/16 of an inch above the deck surface.
3. Course Zenith: Adjust the Rear Height Screw RH until the face of the head is perpendicular with the surface of the deck. Position the Tape Height Gauge (or any gauge known to be square) on the deck surface and move it against the face of the head as shown in Figure 5-14. The gauge used should be demagnetized before using for adjustment. Be careful to avoid scratching the face of the head. When the head is perpendicular, the face of the head and the "square" will be flush.
4. Fine Height and Zenith: This adjustment is made by using a strip of white "leader" tape or a piece of recording tape from which the oxide has been removed. (Shellac thinner, flux remover or a similar solvent will loosen the oxide which can then be wiped off the transparent base.) A test cartridge may also be used for this adjustment (refer to Section IX).
   a. Position the transparent tape across the face of the heads as the tape would be positioned if a cartridge was being played. See Figure 5-15. Check to see that the tape is not being distorted (wrinkled) where it makes contact with the tape guides and attach it to one of the tape guide support blocks with adhesive tape to free one hand for adjustments.

b. Alternately adjust Height Screws FH and RH to position the top of the upper head track (pole piece) so that it is even with the upper edge of the tape, and to position the bottom of the lower head track (pole piece) so that it is even with the lower edge of the tape. Screws FH and RH should be adjusted by equal amounts in the same direction.
c. Re-check the zenith of the head as instructed in Step 3 above.
d. Remove the transparent tape.

J. CARTRIDGE CORNER POST ADJUSTMENT

The ITC head assembly includes three tape guides — the maximum number of tape guides which can be used with NAB type A cartridges. Even with carefully adjusted tape guides, the tracking of the tape as it passes across the recording and reproducing heads can be adversely affected by improper positioning of the corner post in most cartridges. See Figure 5-16.

After the tape has been pulled up out of the center of the endless loop, the cartridge corner post must bring the tape down to the proper height to pass across the heads. If the corner post is too high, the tape will be traveling "downhill" as it encounters the first tape guide and recording head. By the time the tape reaches the reproducing head, it will normally be brought into the proper position; but, in the worse case, tracking across the reproducing head can also be adversely affected by an improperly positioned cartridge corner post.

For optimum results, the tape must travel in a perfect horizontal path through the tape guides and across the heads. When the tape travels "downhill," as in the example cited above, the azimuth positioning of the recording head would be different from that of the reproducing head. In fact, the azimuth positioning of the recording head would vary from cartridge to cartridge if positioning of the cartridge corner posts is not properly maintained.

Several cartridge manufacturers now offer cartridges with vernier adjustments for vertical positioning of the corner post. In older cartridges, proper position can be achieved by using the ITC Tape Height Gauge as shown in Figure 5-16.

1. Place the cartridge and the Tape Height Gauge on a flat surface and advance the gauge between the upper and lower flanges as shown in Figure 5-16. The gauge should advance between the flanges without friction while resting flat on the surface, but there should be no room for noticeable vertical movement of the gauge between the flanges.
2. If adjustment is required, remove the top from the cartridge and raise the upper portion of the corner post from the cartridge base.
3. Sparingly apply a small amount of a general purpose cement to the inside of the corner post mounting hole in the cartridge base.
4. Keeping the Tape Height Gauge flat on the surface, press the corner post into the base until the gauge fits snugly between the two flanges as shown in Figure 5-16.
5. Remove the excess cement and re-check the corner post positioning before replacing the top cover.

K. MONOPHONIC HEAD AZIMUTH ADJUSTMENT

Before attempting these adjustments, insure that the mechanical adjustments of the tape guides as outlined in Section 4-H, and the adjustment of height and zenith of both the Record and Reproduce heads (or Reproduce and "dummy" in Reproduce only machines) as outlined in Section 4—I are correct.

1. Reproduce Head Azimuth Adjustment:
   a. Connect a 600 ohm load to the output terminals. Connect a VTVM across this load.
   b. Insert a 15 kHz Standard Azimuth Alignment Tape and start the machine.
   c. Adjust the azimuth screw A (refer to Figure 5-1 for location) of the reproduce head to produce maximum output level.
   d. Carefully tighten lock screw L, observing the VTVM to insure that no change in output level occurs.
2. Record Head Azimuth Adjustment: It is reminded that changes in azimuth to the Master Record head can result in azimuth errors in all the Reproduce machines within a system unless the resultant azimuth is carefully checked against each of these Reproducers. Any change of azimuth of the record head should be attempted

ONLY AFTER all mechanical adjustments are carefully checked and the Master Reproduce head is aligned to the 15 kHz Standard Azimuth Alignment Tape as above.

a. Select an erased 3½ minute cartridge which has had the corner post properly adjusted (Refer to Section 4-J) and is known to have consistently good operating characteristics.
b. Connect a 600 ohm load to the Reproducer output terminals. Connect a VTVM across this load.
c. Connect an audio generator to the Recorder input terminals. Set the input and Record Level to -10 dbm.
d. Start the Recorder and adjust the azimuth screw A on the record head to produce maximum output level.
e. Carefully tighten lock screw L, observing the VTVM to insure that no change in output level occurs.

L. STEREO SYSTEM HEAD AZIMUTH ADJUSTMENT

Two track stereo recording-reproducing results are subject to several contributing mechanical inaccuracies which can cause phase shift in simultaneously monitored reproducer outputs. In stereo systems these phase shifts are generally not perceptable in the final reproduction; however, in cases where monophonic "dubbing" or channel summing is desired, phase shifts can result in serious amplitude variations or drop-out at the higher frequencies. Most common causes of these problems are:

1. Lateral displacement of the heads with respect to each other within the head case.
2. Improper azimuth of the heads with respect to each other (record head to play head on any reproducer in a system).
3. Improper tape guidance (skew) either within the cartridge or through the tape guide system.

International Tapetronics has attempted to provide the best features possible to assist in the proper guidance of tape outside of the cartridge. Three adjustable tape guides, heavy-duty adjustable head mounts, and the use of "dummy" heads in Reproduce only machines, lend to consistent guidance of the tape through the head assembly. Adjustment procedures for cartridge corner posts in Section IV—J and gauges made available for this purpose are other measures taken by ITC to assist the discriminate in maintaining the best possible stereo performance from this equipment. The following test and adjustments do not preclude the many possible techniques for measuring phase shift, but provide the basis for satisfactory results using a minimum of equipment and skill.

1. Master Reproduce Head Azimuth:
   a. Connect 600 ohm loads to both left and right channel outputs. Connect a VTVM to the left channel output. Insert a FULL TRACK 400 Hz reference "0" level tape and start the machine. Set left gain control R111 for 0 DBM output. Now connect the VTVM to the right channel output and adjust right gain control R 130 for 0 DBM output.
   b. Insert a 15 kHz FULL TRACK azimuth alignment tape and carefully adjust playhead azimuth screw A for a maximum reading on the VTVM. Observe the mechanical position of the azimuth screw.
   c. Move the VTVM to the left channel output. Now move azimuth screw A a small amount in either direction and observe the VTVM reading as an increasing or decreasing output. Continue moving the screw in the direction that produces increasing output until a maximum reading is obtained.
   d. Observe direction and amount that the screw was turned to obtain maximum reading on the left output with respect to the previous setting for maximum on the other channel. Set screw A to the midpoint between these settings to obtain AVERAGE azimuth for the two channels.
   e. Connect the horizontal input of any scope so equipped to the right channel output. Insert a FULL TRACK FREQUENCY ALIGNMENT TAPE and start the machine. Adjust the horizontal gain, if provided on the scope to a suitable amplitude. Remove the horizontal input.

f. Connect the vertical input to the same right channel output and adjust the vertical gain to provide a deflection equal to that of the horizontal above.
g. Now connect the horizontal input to the left channel output. Run the tape to the 400 Hz section. A pattern such as Figure 1 should now appear. If not, reverse the two leads of the horizontal input. This pattern represents the "0" or near "0" phase shift pattern of the system.
h. Allow the tape to run to the 5 kHz section and observe if phase shift has occurred. (Refer to Figures 2 through 4.) If phase shift has occurred, adjust the azimuth screw A to correct this phase shift in the exact reverse rotation to which it has occurred. (This means that if the pattern was increasing clockwise from 0 shift as frequency increased, screw A should be turned in such a way to cause scope display to rotate CCW back to the "0" position.)
i. Now allow the tape to continue through the various frequencies observing the scope display to insure that no 180° reversals occur. At 15 kHz final adjustment of screw A can be made to provide best average phase shift. It is normal for shift "jitters" of several degrees to occur at the highest frequencies, so setting should be based on best results. It is desirable to run the tape several times, observing that phase reversals do not occur at any frequency. Tighten lock screw L and observe that no change occurs.

0 PHASE SHIFT

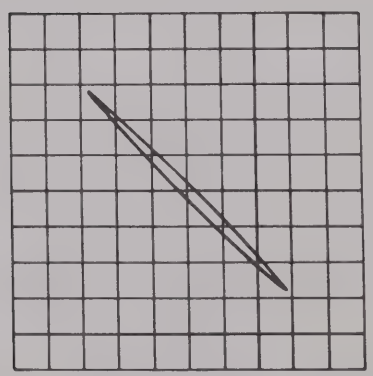


FIG. 1

45° PHASE SHIFT

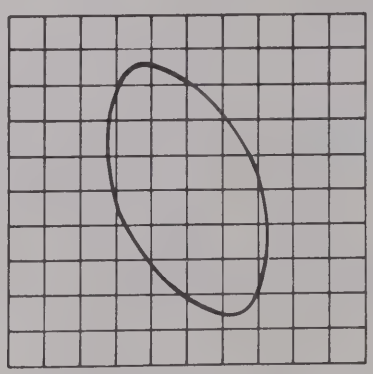


FIG. 2

90° OR 270° SHIFT

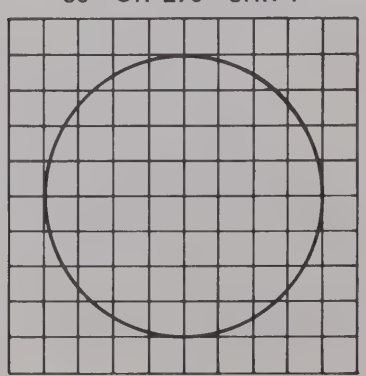


FIG. 3

180° PHASE SHIFT

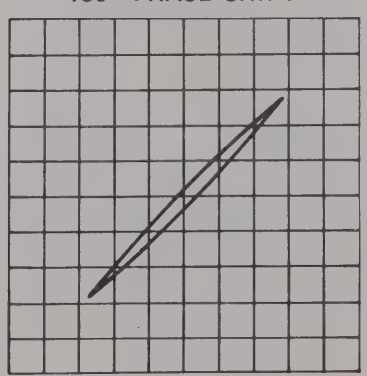


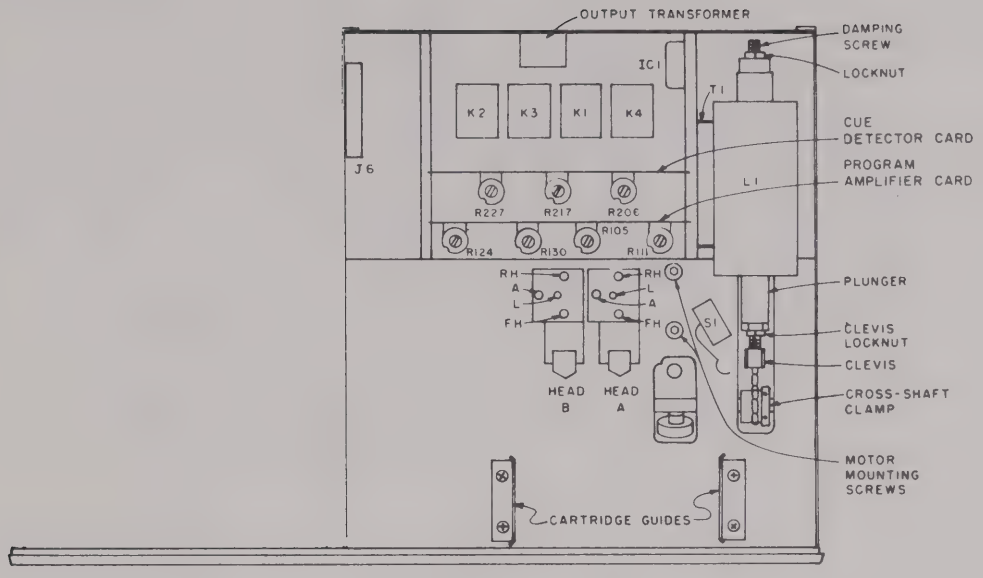
FIG. 4

2. Master Record Head Azimuth:
   a. Select a 3½ minute cartridge that is known to have consistently good operating characteristics and proper adjustment of the corner post.
   b. Connect a 15 kHz tone to both channel inputs on the recorder. (Observe phase relationship of these inputs.) Set the input and Record levels to -10 dbm.
   c. Start the recorder and adjust the azimuth screw A on the record head for maximum amplitude of the display on the scope. (The scope gains may be adjusted in equal amounts to increase amplitude of the display if necessary.)
   d. Sweep the dial on the tone source slowly to 400 Hz and observe phase rotation on the scope display. If 180° reversals occur, adjust screw A (of the record head only) at 5 kHz to produce "0" phase shift. Repeat the 400 Hz to 15 kHz sweep and adjust as necessary to remove phase reversals and provide best average phase shifts at 15 kHz. Tighten lock screw L and observe that no change occurs.
3. Other Reproduce Head Azimuth: It is important to realize that all reproducers within a system must be azimuth aligned to the master recorder. To implement this it is necessary to prepare a test cartridge recorded on the master recorder each time any adjustment to this recorder is performed. This cartridge is in turn used to align EACH reproducer in the system, using the technique outlined in paragraph one above.

M. HEAD REPLACEMENT

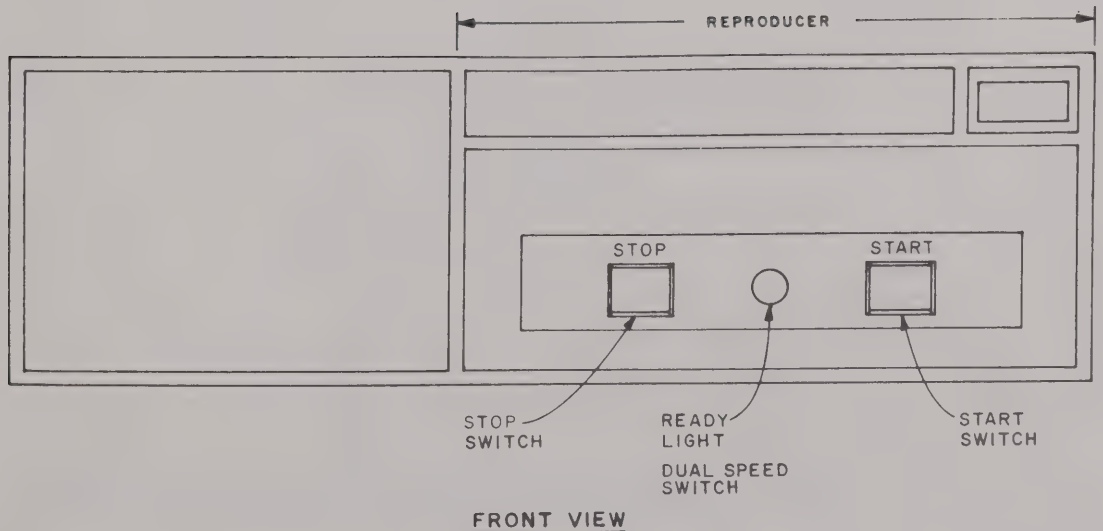
The ITC Reproducers utilize the no-mount type heads to provide quick and easy installation.

1. Loosen the two screws in the head mounting strap.
2. Remove the old head and insert a new one. (The side of the head with the printing on it should be positioned up.)
3. Align the rear edge of the head case so that it is flush with the rear edge of the head mounting strap.
4. Tighten the screws in the head mounting strap.
5. Reconnect the head cable. The locator slot in the head socket of mono units must be on the top side to prevent a reversal of the program and cue channels. See the schematic diagram for the color code of the head lead arrangement used on stereo units.



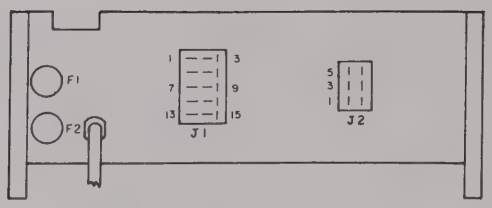
TOP VIEW

FIGURE 5-1



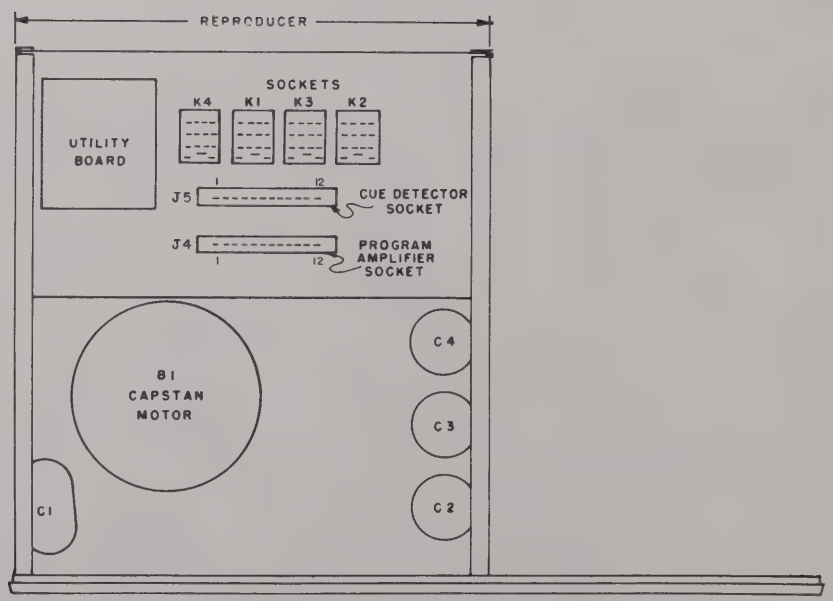
FRONT VIEW

FIGURE 5-2



REAR VIEW

FIGURE 5-3



BOTTOM VIEW

FIGURE 5-4

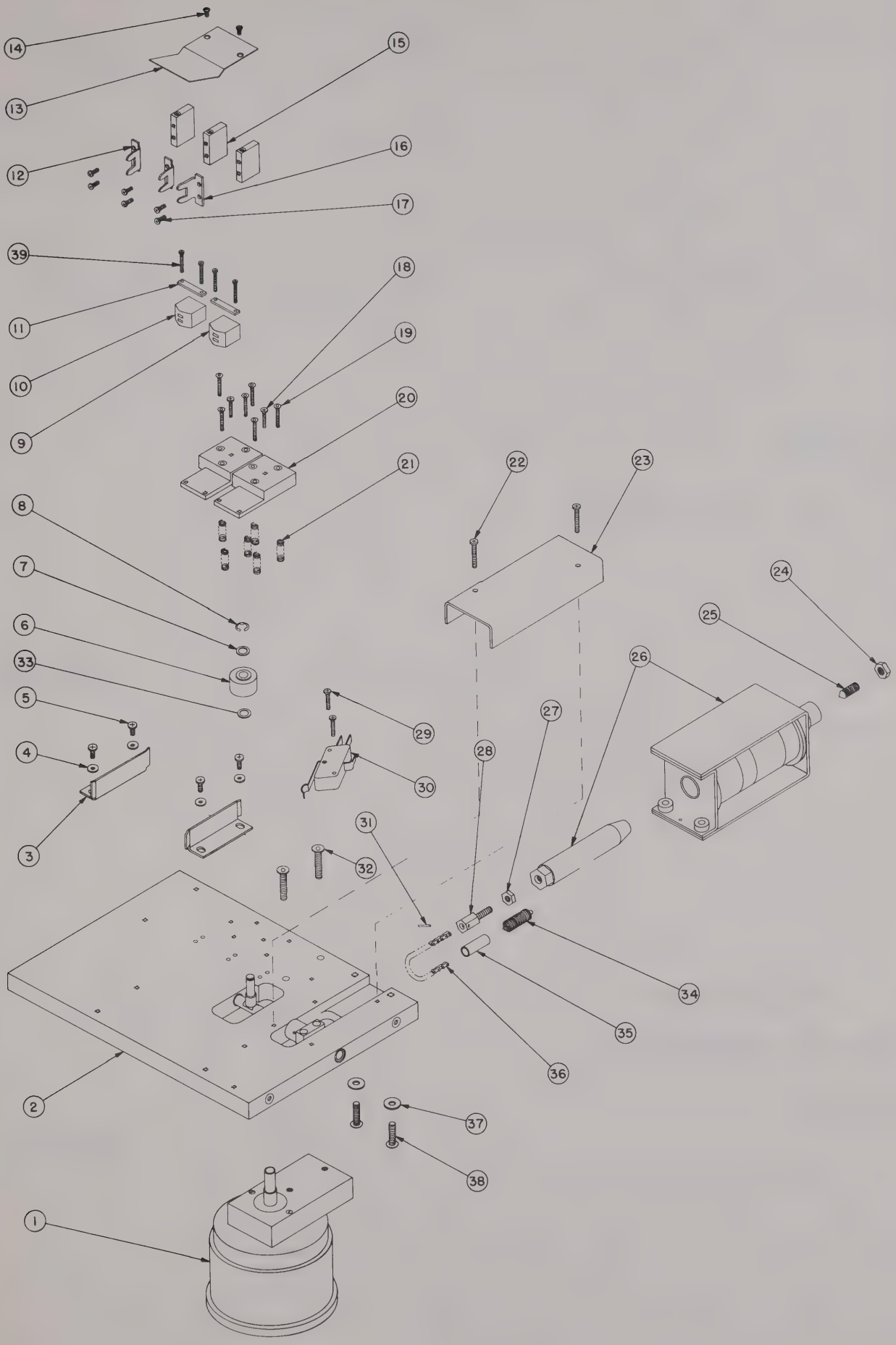
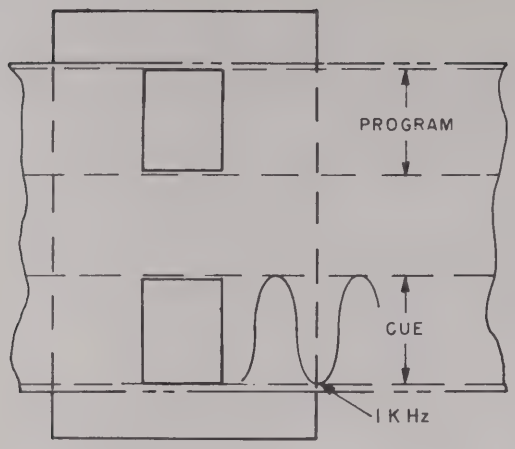

14
15
13
16
12
17
39
18
11
19
10
20
9
21
22
23
8
24
7
25
6
26
33
27
5
29
28
4
30
31
3
32
34
35
36
2
37
38
1

FIGURE 5-5



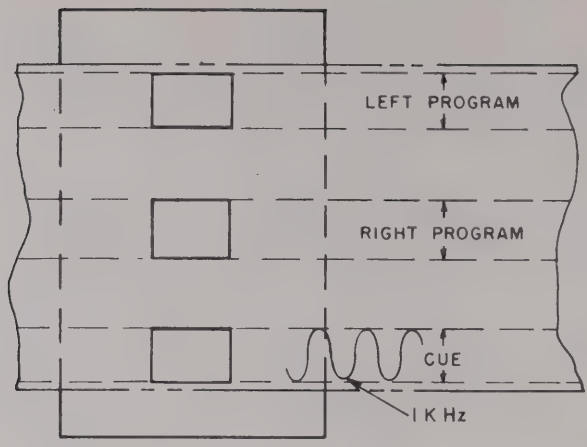


FIGURE 5-6

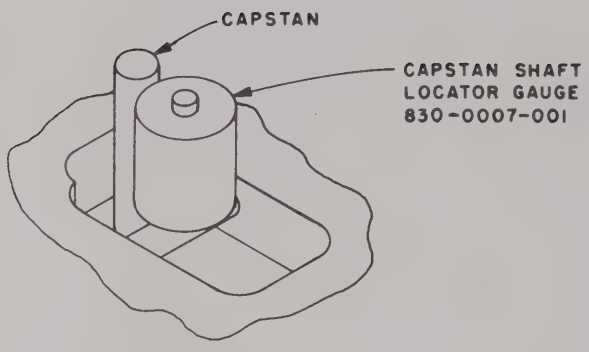


FIGURE 5-7

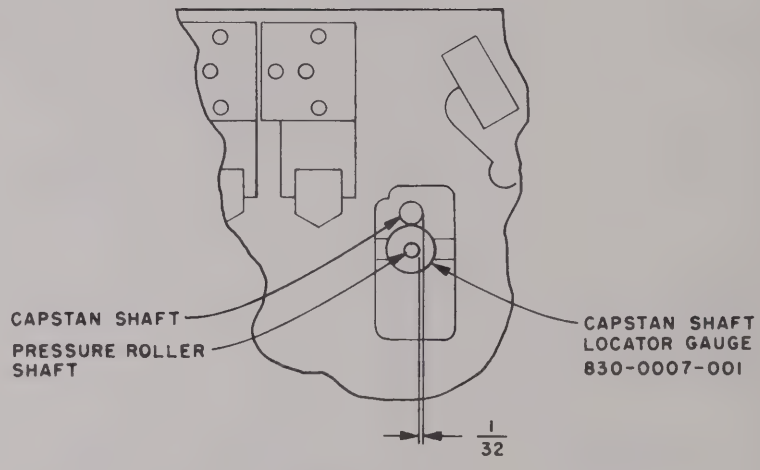


FIGURE 5-8

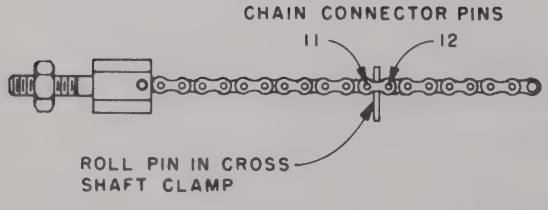


FIGURE 5-9

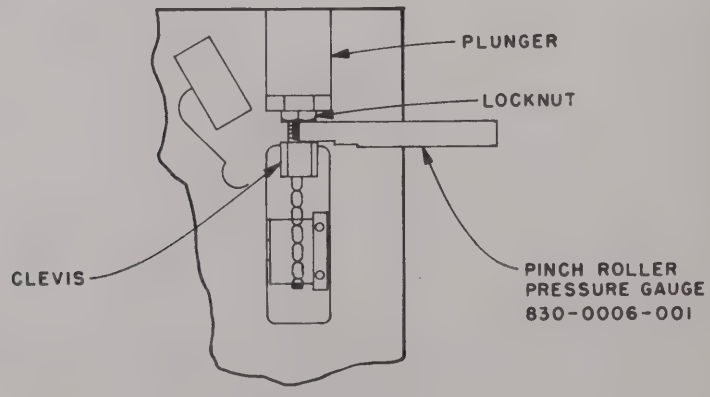


FIGURE 5-10

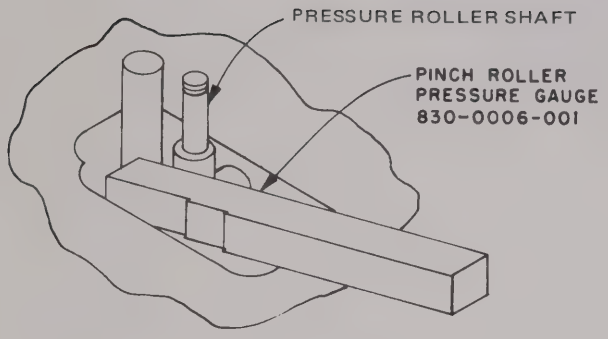


FIGURE 5-11

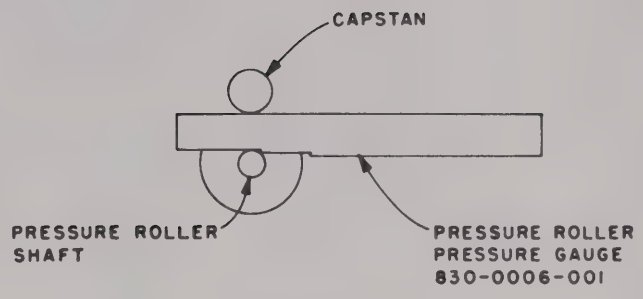


FIGURE 5-12

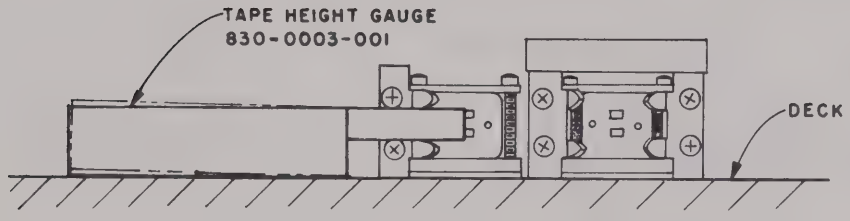


FIGURE 5-13

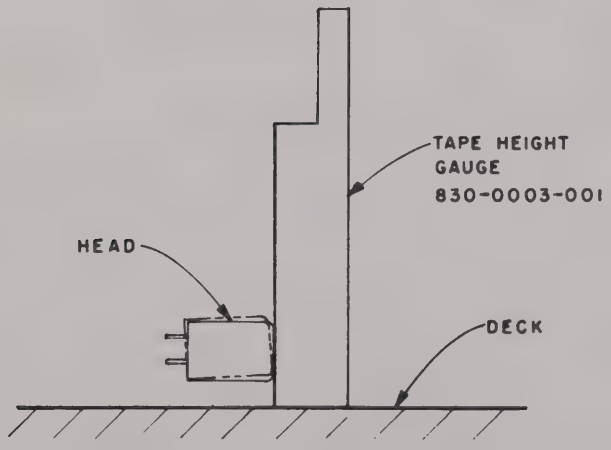


FIGURE 5-14

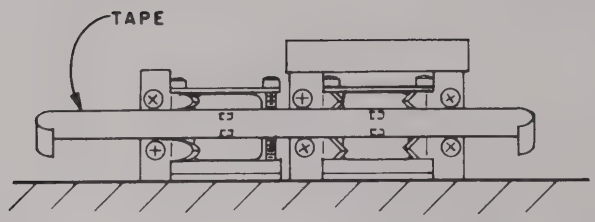


FIGURE 5-15

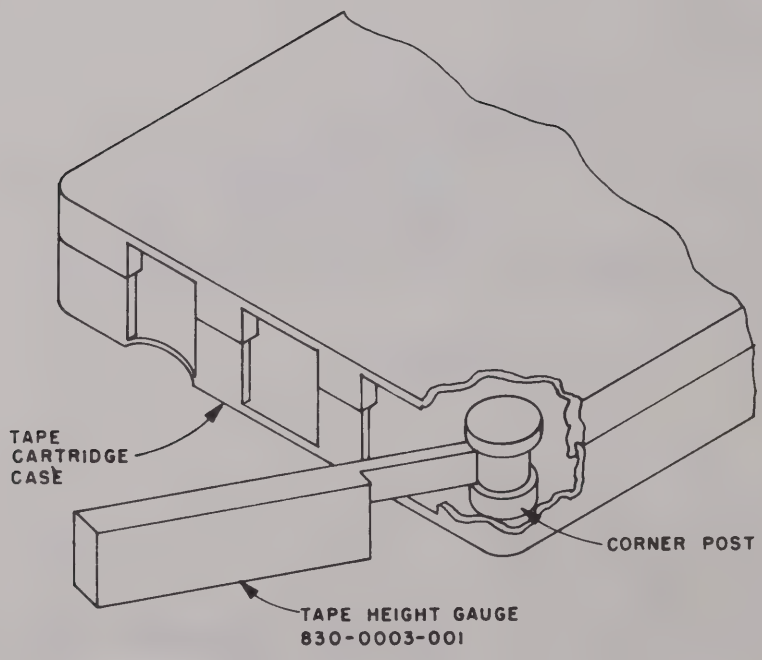


FIGURE 5-16

SECTION VI

MECHANICAL PARTS LIST — SP & WP SERIES REPRODUCERS

(See Figure 5-5)

Item	Part Number	Description
1	451-0001-010	Motor, Capstan, 450 RPM, 117V, 60 Hz
	451-0005-010	Motor, Capstan, 450/1800 RPM, 60 Hz, Hi-Speed Cue
	451-0006-010	Motor, Capstan, 375 RPM, 115V, 50 Hz
	451-0007-010	Motor, Capstan 375/1500 RPM, 117V, 50 Hz, Hi-Speed Cue
2	267-0001-014	Deck, SP Series
	267-0001-034	Deck, WP Series
3	272-0001-001	Guides, Cartridge (two)
4	360-0601-000	Washers (four)
5	350-0604-000	Screws, Cartridge Guide Mtg. (four)
6	291-0003-001	Pressure Roller
7	359-0006-000	Washer, mylar
8	289-0002-000	Clip, retainer
9	504-0002-000	Head, Mono Reproduce, Nortronics, PB2H7KNO
	504-0004-000	Head, Stereo Reproduce, Nortronics, PB3Q7KNO
10	504-0001-000	Head, Dummy
	504-0003-000	Head, Mono Record, Nortronics, PB2H4RNO (on WP Series only when used with recording amp)
	504-0005-000	Head, Stereo Record, Nortronics, PB3Q4RNO (on WP Series only when used with recording amp)
11	303-0001-001	Straps, Head Mounting (two)
12	272-0003-001	Guide, Tape, Left (one)
13	301-0001-011	Spring, Cartridge Hold-Down
14	350-0402-000	Screws, Cartridge Spring Mtg. (two)
15	304-0001-001	Supports, Tape Guide (three)
16	272-0002-002	Guides, Tape, Center and Right (two)
17	350-0403-000	Screws, Tape Guide Mtg. (six)
18	350-0415-000	Screws, Head Block Locking (two)
19	353-0001-000	Screws, Head Block Azimuth and Height (six)
20	253-0035-002	Blocks, Head Mounting (two)
21	301-0003-001	Springs, Compression, Head Block Support (six)
22	350-0422-000	Screws, Solenoid Plunger Cover Mtg. (two)
23	265-0011-011	Cover, Solenoid Plunger
26	477-0006-002	Solenoid Coil and Plunger
27	370-1001-000	Nut, Lock, Clevis Screw
28	264-0001-001	Clevis, Screw (Solenoid Linkage)
29	350-0420-000	Screws, Micro Switch Mtg., (two)
30	392-0001-000	Switch, Micro (two)
31	282-0001-001	Pin, Roll
32	353-0004-000	Screws, Motor Mounting
33	360-1005-000	Washer, steel
34	301-0005-000	Spring, Expansion, Solenoid Linkage Return
35	441-0004-010	Tubing
36	277-0001-001	Chain, Solenoid Linkage
37	360-1003-000	Washers (two)
38	353-0003-000	Screws, Solenoid Mounting (two)
39	350-0307-000	Screws, Head Mtg. (four)

MISCELLANEOUS MECHANICAL PARTS

311-0009-000	Foot, plastic
830-0003-001	Gauge, Tape Height
830-0006-001	Gauge, Pressure Roller Pressure
830-0007-001	Gauge, Capstan Shaft Locator

A. GENERAL INFORMATION

This section of the manual describes the electronic circuitry and the way in which it works. The symbol designations referred to are used on the schematic diagram for the SP/WP Reproducers. The WP Reproducer is designed so that it may be used in conjunction with a recording amplifier. The SP Reproducer is designed as a play only device with no recorder interconnect circuitry supplied.

B. SOLENOID POWER SUPPLY

Diodes CR1, CR2, CR3, and CR4 are a full wave bridge rectifier which furnishes 110 volts DC to the solenoid power supply filter. The dual section filter consists of R1, R9, and the two sections of C2. The diodes and resistors are located on the Utility Power Supply board (see Figure 5-4 for the board location) while the filter capacitors are mounted on the under side of the deck (see Figure 5-4). The output of 110 volts DC (under load) is switched by the parallel contacts 7 and 11 / 8 and 12 of control relay K1. A network consisting of C13 and R17 is across the coil of solenoid L1 for transient protection when power is removed.

C. LOW VOLTAGE POWER SUPPLY

Transformer T1 provides low voltage AC (with the center tap grounded) to diodes CR6 and CR7, a full wave rectifier that supplies the input to the regulated power supply. Capacitor C3 acts as an input filter. The diodes and resistors of this power supply are mounted on the Utility Power Supply board (see Figure 5-4 for the board location) while the filter capacitors are located on the under side of the deck (see Figure 5-4).

IC1 is the regulated power supply. (See Figure 5-1 for location.) The output of this power supply is +24 volts. The regulated power supply is protected by F1, a fast acting ½ ampere fuse. The output of the regulated power supply is represented on the schematic diagram by a triangle which is common to all other points on the schematic shown with a like symbol. R3 and C4 provide decoupling and additional filtering for the program amplifier card.

The case of IC1 is insulated from the chassis by a mica washer to prevent hum loops. To provide maximum heat dissipation, the mica washer is coated on both sides with thermal conductive agent and IC1 is held firmly in place with two mounting screws.

D. CONTROL CIRCUITRY

The chassis control circuitry is furnished with power by the low voltage DC power supply and utilizes ground switching. At all times other than when a primary (1 kHz) cue tone is being detected, positive voltage is routed from the low voltage DC power supply through R215 and CR205 on the cue card to control relay, K1. When a cartridge has been properly inserted in the deck, the cartridge sensing micro switch S1 closes furnishing ground information through contacts 2 and 10 on relay K1 and pin 2 on J5 to the stop cue tone protection circuit on the cue card, the action of which is described under Cue Circuitry. This same "ready" ground is furnished through CR8 and R4 to illuminate I3, the "ready" lamp, and through R5 to a remote "ready" lamp. See Figure 5-4 for the location of the control relays and the Utility Power Supply Board.

The ground furnished through S1 is routed to S3, the Stop Switch, through pin 4 on J1 to a remote stop switch, through the jumper installed between pins 3 and 4 on J1 to S2, the Start Switch, and through pin 3 on J1 to a remote start switch. On the WP Series the ground arriving at the Start Switch is also made available to a recording amplifier through pin 18 on J6 and through contacts 9 and 1 on K1 and pin 15 on J6.

With conditions described above, pressing the Start Switch presents a ground to pin 13, the coil of K1, the control relay, which energizes and holds itself energized by closing contacts 5 and 9. Contacts 1 and 9 open removing the "ready" ground from the recording amplifier. Contacts 2 and 10 open removing the "ready" ground from the stop tone cue protection circuit and the Ready lamps. Contacts 6 and 10 close providing a ground through R6 to a remote run lamp and to the audio squelch to turn on the audio. Parallel contacts 7 and 11 / 8 and 12 close completing the circuit to energize the solenoid.

When a primary (1 kHz) cue tone is detected, transistor Q203 turns on and takes the junction of R215 and CR205 to ground, removing the positive holding voltage from K1.

Pressing S3, the Stop Switch, accomplishes the same thing with a normally open, momentary action switch which eliminates the disadvantages of a series stop circuit. If for any reason a series remote stop circuit is required, the normally open stop circuit can be replaced with a normally closed circuit by removing the jumper installed inside the machine between pins 3 and 4 on J1

and installing a remote, normally closed switch in its place.

When a secondary (150 Hz) cue tone is sensed, relay K2 is energized. A contact closure is then provided on pins 10 and 11 of J1 by parallel contacts 5 and 9 / 6 and 10. The closure of contacts 8 and 12 shorts out dropping resistor R7 providing a brighter illumination of the Run Lamp as an indication of 150 Hz cue tone detection. Contacts 7 and 11 short out R6 in the remote run lamp circuit.

Relay K3 is energized when a 8 kHz tone is detected. A contact closure is provided on pins 12 and 13 of J1 by parallel contacts 5 and 9 / 6 and 10. The closure of contacts 8 and 12 provides an indication of the 8 kHz cue tone detection by returning the ground to the Ready Lamp circuit. Diode CR8 functions as a blocking diode and prevents this ground from being presented to the stop cue tone protection circuit.

E. CUE CIRCUITRY

The plug-in Cue Detector card is located in the second position at the rear of the deck assembly. The 1 kHz Primary Cue detector and the optional 150 Hz and 8 kHz detectors when so equipped are designed to operate from tones as specified in the NAB Standards.

Transistors Q210 and Q211 are the equalized preamplifier stages which provide essentially equal voltage for each of the normal level cue tones to the common signal bus of the three detectors (when so equipped).

Diodes CR201 and CR202 act as a signal limiter to prevent the signal bus from exceeding the detector input maximum level of approximately .5 volts. This bus is also supplied to the remote socket J1 (Pin 15) and to the recorder meter circuits via J6 (Pin 2) of WP Series Reproducers.

The 1 kHz Primary Cue section contains a stop cue tone protection circuit which prevents the machine from being stopped by a 1 kHz tone for approximately two seconds after the unit is started. While the reproducer is sitting idle with a cartridge inserted (cartridge sensing micro switch S1 closed), capacitor C206 is discharged through R204, CR203, contacts 2 and 10 of relay K1, and S1 to ground. When the reproducer is started, the discharge path is opened by relay K1; and C206 begins to be charged by the 24 volt DC power supply through resistor R203. While C206 is charging, the base of Q201 is clamped sufficiently close to ground to prevent operation of the 1 kHz detector. When C206 is charged to approximately 11 volts, diode CR204 is reverse biased and the clamp is removed.

In the 1 kHz Primary Cue Section, a series resonant circuit consisting of L201, C208 and C209 provides a low impedance regenerative circuit for Q201 at 1 kHz, while attenuating frequencies more than a few percent above or below 1 kHz. Transistor Q202 is a zero bias signal rectifier which amplifies positive current pulses present at its base. R212, R213 and C210 act as the rectifier load and coupling network to switching transistor Q203. This configuration also acts to filter out any transients that may be present on incoming signals. Q203 diverts current flow from relay coil K1 during the cue tone and causes it to de-energize and stop the tape drive.

The operation of the 150 Hz Secondary and 8 kHz Tertiary Cue sections is, in principle, the same — except that the tuned circuit is designed for the respective frequency. Since no tone protection is provided in these circuits, the 150 Hz and 8 kHz detectors are free to operate at any time. Switching transistors Q209 and Q206, when conducting, operate relays K2 and K3 respectively.

NOTE: The NAB standards specify that the Primary Cue tone oscillator generate a tone of 925 Hz to 1075 Hz. Many older cartridge recorders produce a stop cue tone that is well outside these tolerances.

A broad-band cue detector is supplied in ITC single cue tone machines. This broad-band cue detector will pass a wide range of frequencies which permits proper cueing of cartridges recorded on older machines. The broad-band characteristics will cause no problem as long as only single cue tone operation is used. Components C220 and C221 provide the broad-band operation.

The broad-band detector can be changed to the narrow band mode (1 kHz ± 75 Hz) by removing the white wire strap that is on top of the detector PC card. In addition, it may be necessary to increase the gain of the detector by turning the sensitivity control clockwise. (The detector has about 10 dB less gain in the narrow band mode.)

F. PROGRAM PLAY CIRCUITRY

The program play amplifier is located on the plug-in PC Card immediately to the rear of the deck assembly. Single monophonic or dual stereophonic amplifiers of identical design are on the same card, depending upon machine design.

Transistors Q101 and Q102 are the high stability equalized pre-amplifier stages. Adjustable AC feedback equalization is employed to improve input impedance. These components are C104, R104 and R105 in the L. Channel amplifier. Out-

put from these stages is coupled through the electronic attenuator IC101 to the gain control R111. Audio is muted by IC101 in all but the run mode. Transistors Q103 and Q104 are conventional voltage amplifiers, each with local AC feedback employed. The output is connected via edge pin 1 to the balanced output transformer T2. Output impedance is normally 600 ohms but may be changed to 150 ohms by re-connection of the secondary wires. Refer to the schematic notes.

G. HIGH SPEED CUE CIRCUITRY (WHEN SO EQUIPPED)

The function of the Hi-Speed option on the Reproducer is to automatically produce a high speed run mode of the capstan motor when an end of message tone (150 Hz) is detected or when the dual speed switch (Figure 5-2) is pressed. The Reproducer will remain in the "fast" run mode until a stop tone (1 kHz) is detected or the stop switch (Figure 5-2) is pressed. While the Reproducer is in the "fast" run mode, the 1 kHz tone becomes approximately 4 kHz and the 150 Hz tone becomes approximately 600 Hz. The Reproducer can only be placed in high speed operation during the "run" mode because contacts (6 / 10) of K1 are closed only during this mode. During the high speed operation of the Reproducer the power indicator light is "OFF," indicating this state of operation.

During the normal run mode capacitor C9 is charged to +24 volts and remains at this steady state until an end of message tone (150 Hz) energizes relay K2. Relay K2 then places one side of C9 at ground potential and discharges the capacitor. When the end of message tone terminates, the relay K2 returns to the normal run position and the capacitor C9 charges through the coil of the relay K4. This energizes K4 which switches the capstan motor into the fast mode. By changing the windings then poles 1 and 2 and paralleling the run capacitor C1 with C16 the charge time of C9, R13 allows K2 to return to the normal run position creating a hold circuit for K4 through pins (7 / 11) of K4, pins (4 / 12) of K2, and pins (6 / 10) of K1. The fast run mode remains until a cue tone (1 kHz) is detected and stops the tape drive.

Two transistors Q101 and Q102 and their associated components are added to the utility card (figure 10-5). Q101 is the lamp inverter to turn off I4 during the fast mode. Q102 is on during the fast mode and operates as the 1 kHz broadbanding switch, and to inhibit the Secondary and Tertiary tone detectors.

The Hi-Speed Cue Card is substituted in the same card location and connector wiring for the standard cue card. The pre-amplifier and limiter components and those associated with the optional 150 Hz and 8 kHz detectors are similar to the description of the standard circuit described in Paragraph E of this section. The 1 kHz Primary Cue detector is entirely of different design and operates as follows:

The 1 kHz cue gain control R206 adjusts the operation of the detector from full off to approximately -10 dB lower than normal recorded tone level.

Transistor Q201 is a dual purpose tuned amplifier. During the normal mode L201 provides a tuned circuit for the emitter at 1 kHz and attenuates all frequencies more than a few percent above or below this frequency. During the fast mode the emitter of Q201 is re-generated to ground thru C230, edge connector pin 8 and transistor Q102. This causes the amplifier to be broadbanded to frequencies above 1 kHz. Capacitor C221 provides a roll off above 4 kHz to reduce the response to the 8 kHz tone when used.

Transistor Q202 operates as a zero bias rectifier and current amplifier. C210 acts as the ripple filter. When DC voltage rises to +12 volts or higher CR208 conducts to the base of Q203 which turns on and diverts current from relay K1 and causes the tape drive to stop.

L204 and C228 form a series resonant circuit tuned to approximately 600 Hz. The capacitive reactance of C228 causes an increasing E drop at all frequencies 600 Hz and lower and is coupled thru R245 to the base of Q212, which is connected across C210. This causes frequencies 600 Hz and lower to be inhibited from operation of the 1 kHz cue detector.

A. CONTROLS

The various electrical controls listed below are adjusted at the factory to provide optimum operation of the ITC Reproducer. At the time of installation, the only control which may require adjustment is Program Level.

A good maintenance schedule will include periodic checks (weekly or monthly, depending upon the operational requirements) of the machine's electronics. Remember to demagnetize the heads and check their mechanical adjustments first. Minor adjustment of the electronic controls may be required to compensate for normal head wear, but the need for large adjustments may indicate need for head replacement, or failure which requires further testing. See Figure 5-1 for the location of the electronic controls.

1. **Program Level:** The output level of the program amplifier(s) is factory adjusted to produce 0 dBm when reproducing a NAB standard reference level tape, 400 Hz. R111 is the control for mono reproducers, and the left channel of stereo units. R130 is the right channel control on stereo units. When outputs below -10 DBM are required, the addition of an external pad should be considered to maintain optimum signal to noise ratio.
2. **Program Equalization:** The equalization of the program amplifier(s) is factory adjusted to meet the NAB specifications when reproducing a Standard Frequency Response tape. The control(s) may be adjusted to compensate for normal head wear and for variations in heads when replacement is required. R105 is the control for mono units, and the left channel of stereo units. R124 is the right channel control for stereo units. Adjustment of the equalization controls should not be attempted until the reproduce head has been properly azimuth aligned using the procedure outlined in Section 4-K (Section 4-L for stereo) of this manual. Following this procedure, the equalization control should be adjusted to provide the flattest response to the Standard Frequency Response Tape.
3. **Primary (1 kHz) Cue Sensitivity:** The sensitivity of the 1 kHz Primary Cue Detector is increased by turning R206 in the clockwise direction. This control should be adjusted to the point of just responding to the 1 kHz tones recorded on a test tape at 8 dB lower than NAB Cue Level.
4. **Secondary (150 Hz) Cue Sensitivity:** The sensitivity of the 150 Hz Secondary Cue Detector is increased by turning R227 in the clockwise direction. This control should be adjusted to the point of just responding to the 150 Hz tones recorded on a test tape at 8 dB lower than NAB Secondary Cue Level.
5. **Tertiary (8 kHz) Cue Sensitivity:** The sensitivity of the 8 kHz Tertiary Cue Detector is increased by turning R217 in the clockwise direction. This control should be adjusted to the point of just responding to the 8 kHz tones recorded on a test tape at 8 dB lower than NAB Tertiary Cue Level.

A. PREVENTIVE MAINTENANCE

Preventive maintenance of the electrical adjustments should be done on monthly schedule. Each installation should be equipped with a primary test cartridge such as the NAB Standard Test Tape.

Should a primary test cartridge be used to test several tape transports on a monthly basis, the short wave length sensitivity will be degraded by repeated playing. The proper handling and storing of the Primary Test Cartridge, and proper cleaning of heads and tape guides will minimize signal loss. The best method to preserve a primary test cartridge is to record your own test cartridges as outlined below and compare them with the primary test cartridge every six months. It is important that all test cartridges contain the same type of tape that is used for normal recording.

B. TEST CARTRIDGES

1. **Test Cartridge No. 1:** Carefully align the reproducer to the Primary Test Cartridge for azimuth and level. Verify the proper adjustment of the recorder electronics and the recording head azimuth. Select a properly erased cartridge of known good guidance. Record a 15 kHz azimuth tone at -10 dB level for 30 seconds. Follow this tone with 400 Hz, 10 kHz, 5 kHz, 2500 Hz, 1 kHz, 250 Hz, 100 Hz and 50 Hz tones at -10 dB level and 5 seconds duration. The last tone should be 400 Hz at 0 dB level of 20 seconds duration. This tape can now be used for day to day response tests as a second generation standard.
2. **Test Cartridge No. 2:** (Refer to the recorder instructions for adjusting the level of the tone oscillators.) Temporarily connect the cue head to the properly calibrated program amplifier input. With an erased tape, adjust these tone oscillator levels to 8 dB below normal. The program amplifier will play at -7.6 dB for 1 kHz, -1.9 dB for 150 Hz and -17.4 dB for 8 kHz. Record each tone at an interval of approximately 5 seconds at this level. Set this tape aside. With another tape, return the tone oscillators to their proper settings (+0.4 dB for 1 kHz, +6.1 dB for 150 Hz, and -9.4 dB for 8 kHz). The -8 dB tone tape may now be used as required to adjust the tone detector levels to just reliably operate at the -8 dB from normal tone level setting.
3. **Test Cartridge No. 3:** Using a long cartridge, record a single 1 kHz cue tone on the cue track. Accurately time this cartridge in several machines. Average the playing time and mark the exact time on the rear of this cartridge.

   If a frequency counter is available, record a 12 kHz tone on the program track at -10 dB. Play this cartridge in two or more tape transports and measure the frequency of the tone. Average the measurements and mark the frequency on the rear of the cartridge.
4. **Test Cartridge No. 4:** This cartridge is to be used for the height adjustment of the heads during the run mode. The cartridge has the pressure pads removed and the top section is cut out to allow observation of the tape travel across the heads. Since the pressure pads are removed, the tape travel across the cartridge face must be checked to be sure it is parallel with the base of the case.

C. USE OF TEST CARTRIDGES

1. **Mechanical Head Adjustment:** Place test cartridge No. 4 in the tape transport and check the tape travel across the tape heads. (Refer to Figure 5-15.) If the tape travel is incorrect, perform adjustment in accordance with Section 4-F, G, H, and I.
2. **Program Playback Level:** The output level of the program amplifier is factory adjusted for 0 DBM when reproducing the NAB Standard Reference Level Tape, 400 Hz. Test cartridge No. 1 may be used to adjust this level as required. Refer to Section 8-1 for these adjustments.
3. **Program Playback Equalization:** Equalization of the program amplifier(s) is adjusted for flattest response. Test cartridge No. 1 may be used to adjust this response when necessary. It is cautioned not to attempt this adjustment until reproduce head azimuth adjustment of Section 4-K or L is performed.
4. **Cue Detector(s) Sensitivity:** Test cartridge No. 2 is used to make adjustments as required. Refer to Section 8-3, 4, and 5 for these adjustments.
5. **Machine Speed Tests:** Test cartridge No. 3 is used for the periodic speed test. Insert this cartridge in the machine and measure the running time. If the running time is outside the 0.1% specification, refer to the mechanical adjustments in Section 4 and perform these as necessary to restore proper timing.

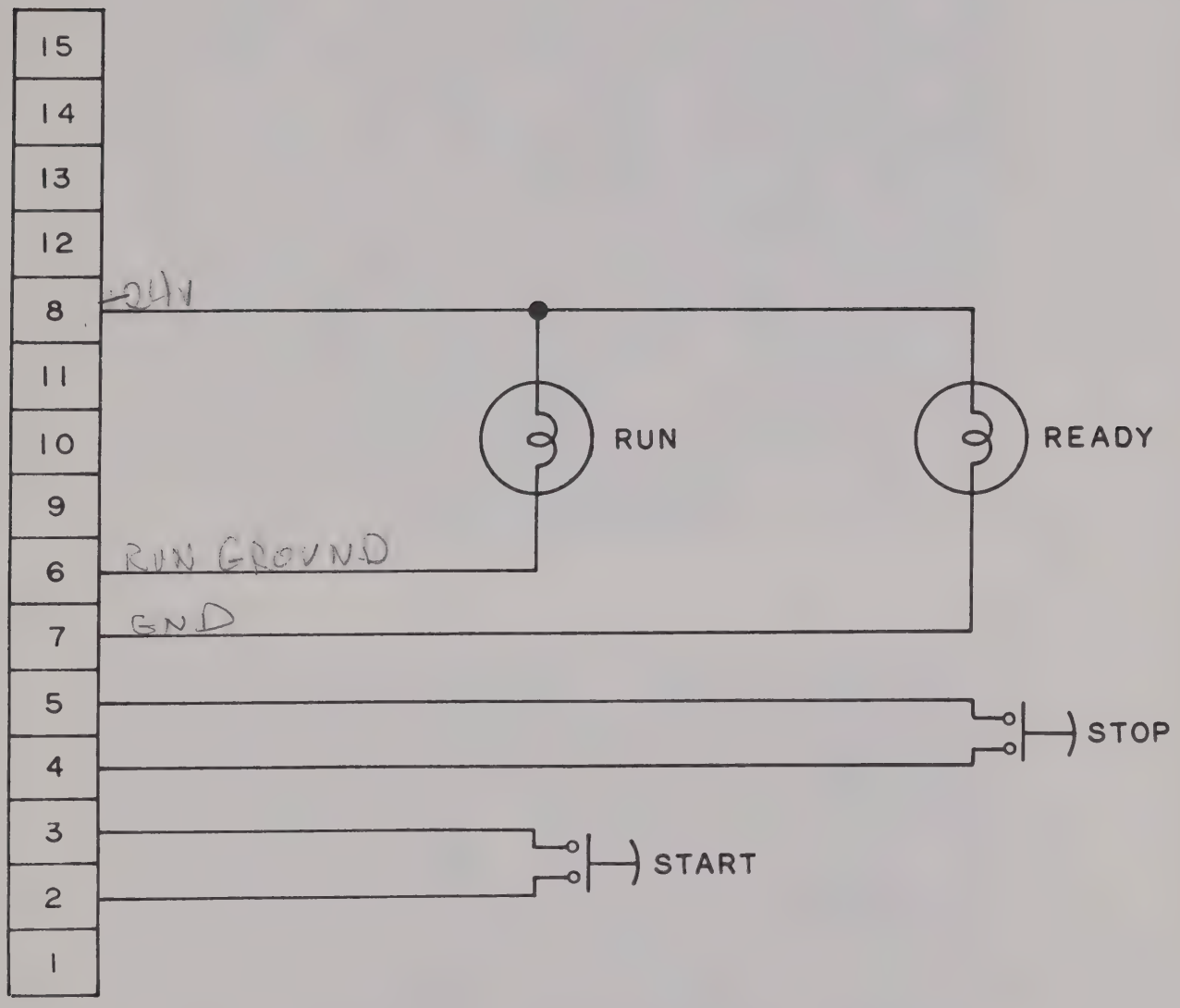
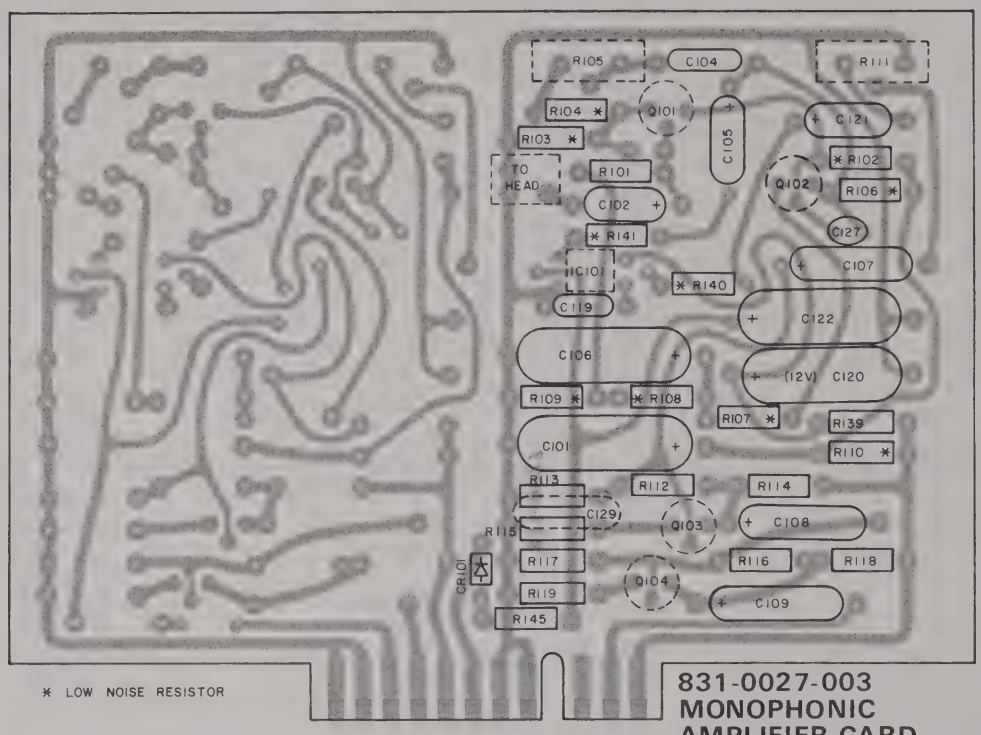


FIGURE 10-1

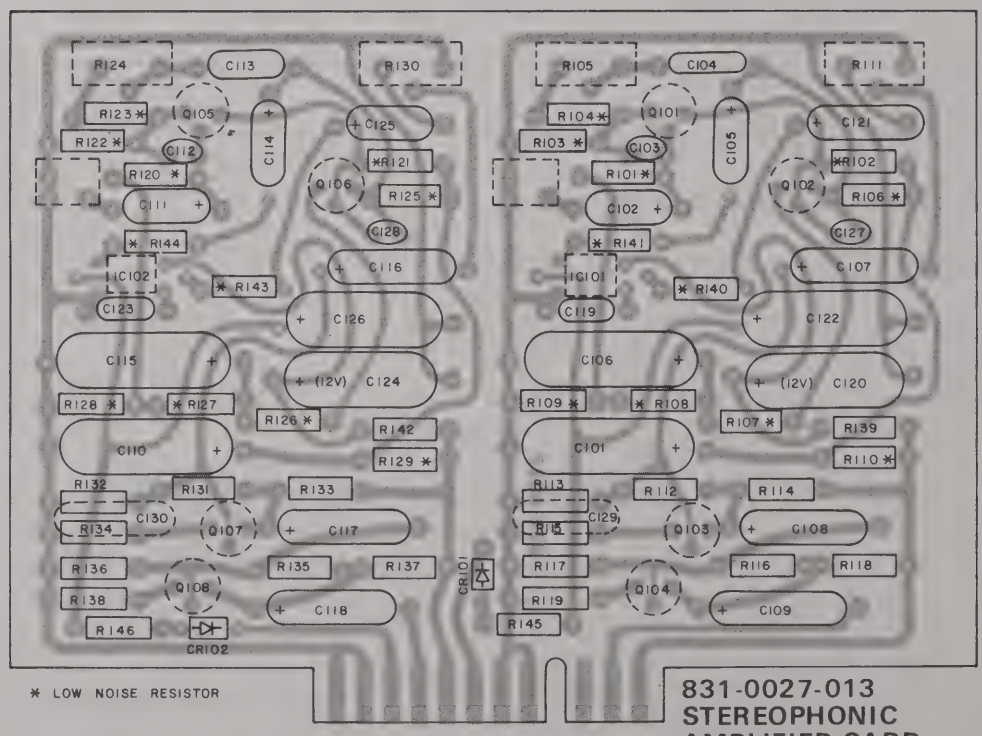
SAMPLE REMOTE CONTROL SCHEMATIC

PROGRAM AMPLIFIER CARD



* LOW NOISE RESISTOR

831-0027-003
MONOPHONIC
AMPLIFIER CARD

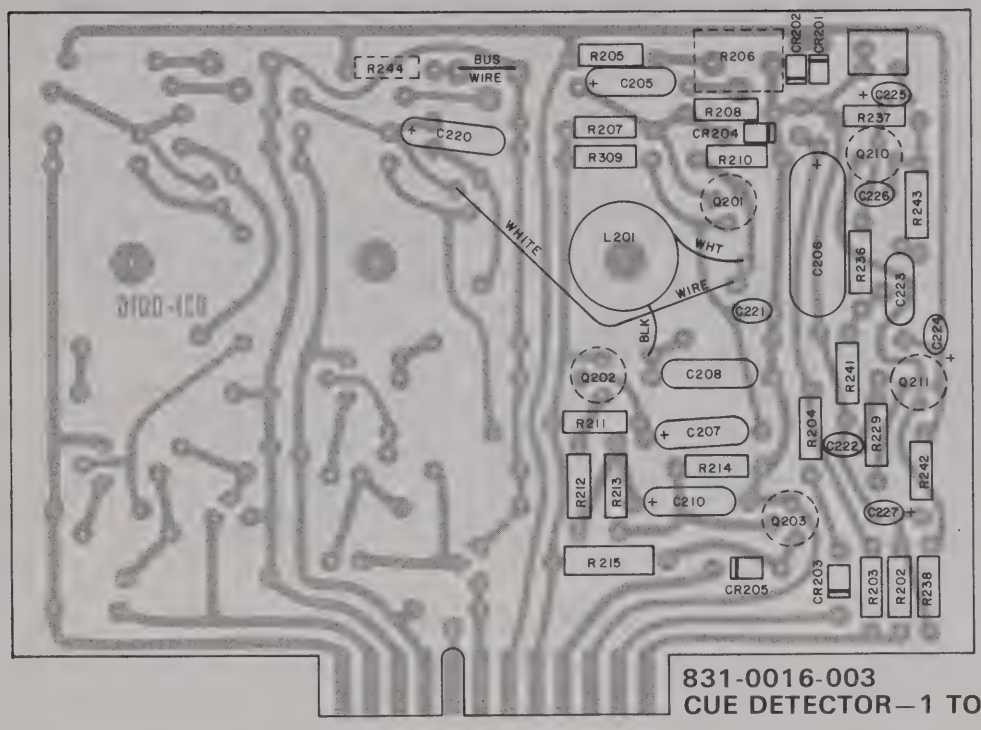


* LOW NOISE RESISTOR

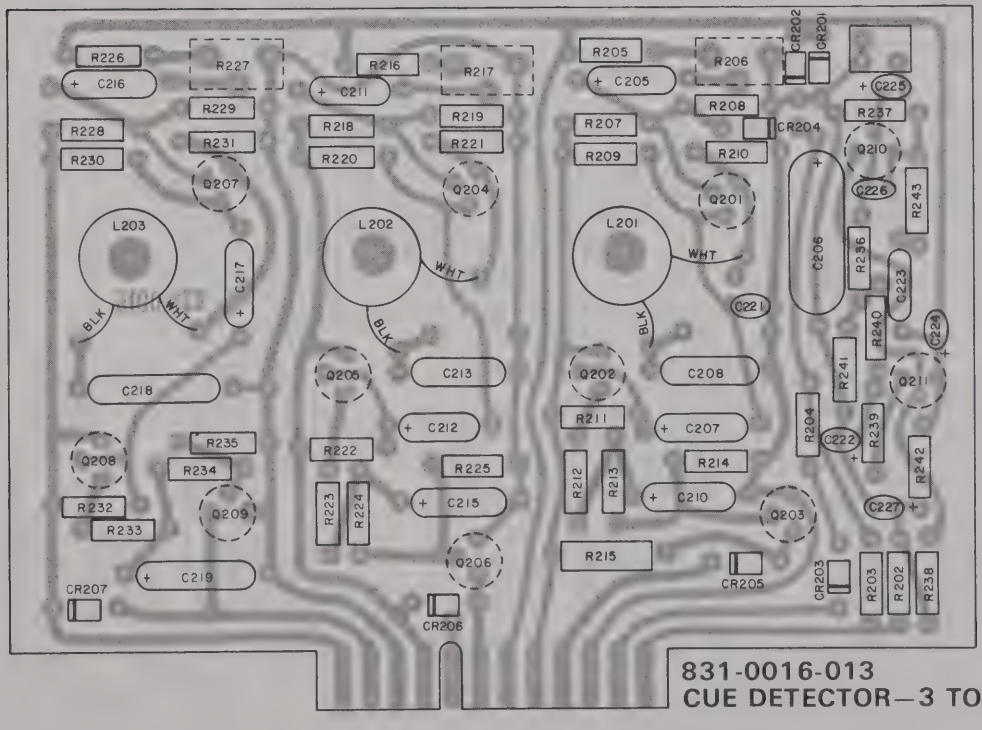
831-0027-013
STEREOPHONIC
AMPLIFIER CARD

FIGURE 10-2

CUE DETECTOR CARD

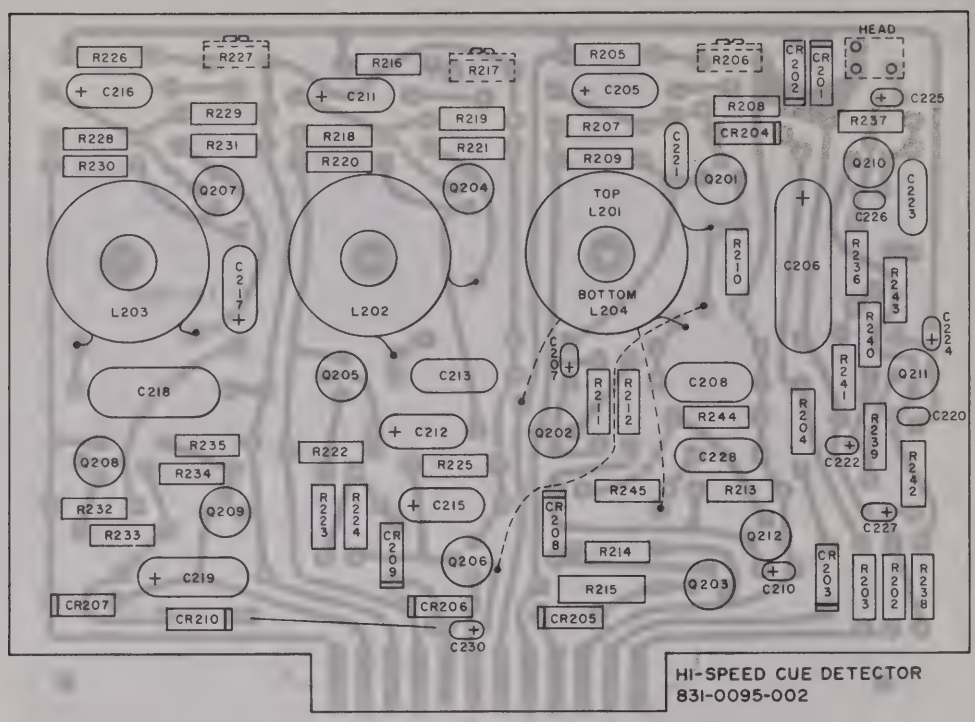


831-0016-003
CUE DETECTOR—1 TONE

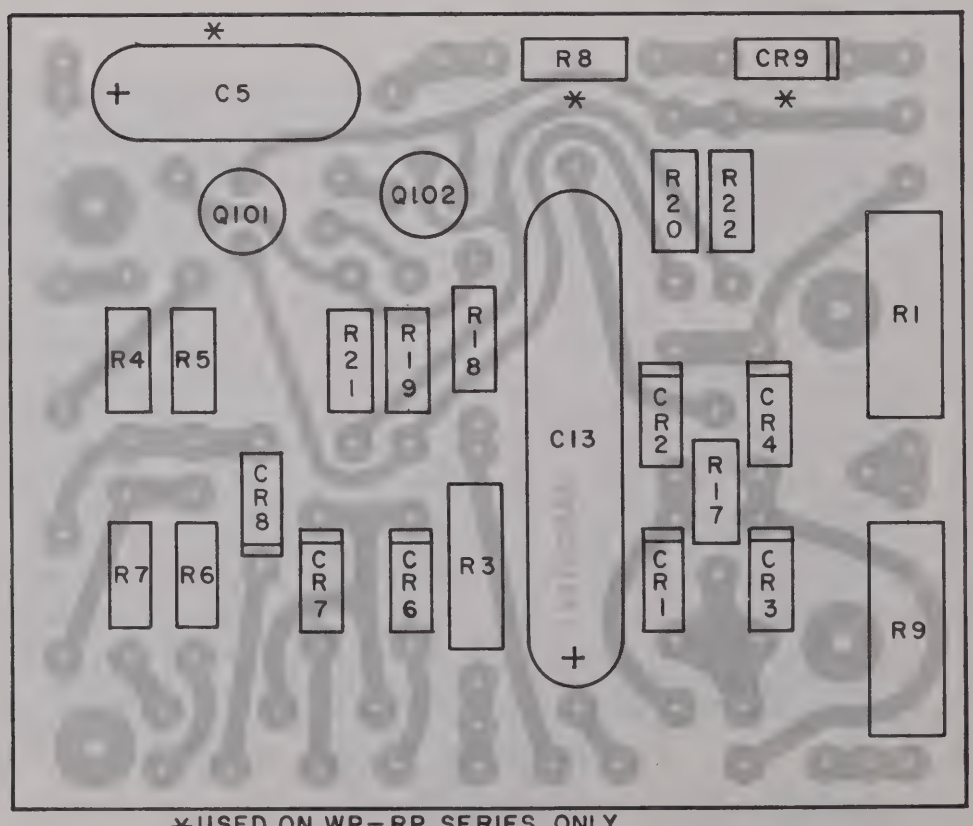


831-0016-013
CUE DETECTOR—3 TONE

FIGURE 10-3



HI-SPEED CUE DETECTOR
FIGURE 10-4



*USED ON WP-RP SERIES ONLY

UTILITY BOARD
831-0099
FIGURE 10-5

SECTION XI

ELECTRICAL PARTS LIST — SP & WP SERIES REPRODUCERS

A. CHASSIS

Symbol	Part Number	Description
		MOTORS
B1	451-0001-010	Capstan, 450 RPM, 110 V., 60 Hz
	451-0005-010	Capstan, 450/ 1800 RPM, 110 V., 60 Hz (Hi-Speed Cue)
	451-0006-010	Capstan, 500 RPM, 110 V., 50 Hz
	451-0007-010	Capstan, 375/ 1500 RPM, 110 V., 50 Hz (Hi-Speed Cue)
		CAPACITORS
C1	683-0001-000	1.5 mfd, 370 VAC (for 60 Hz motor)
	683-0004-000	3.0 mfd, 370 VAC (for Hi-Speed Cue, 60 Hz motor)
	683-0003-000	2.0 mfd, 370 VAC (for 50 Hz motors)
C2	698-0003-000	100/ 100 mfd, 250 V.
C3	698-0001-000	1000 mfd, 50 V.
C4	698-0001-000	1000 mfd, 50 V.
C5	696-0078-000	100 mfd, 12 V. (WP Series)
C6	686-0001-000	.1 mfd, 500 V. (Hi-Speed Cue)
C7	686-0001-000	.1 mfd, 500 V. (Hi-Speed Cue)
C9	696-0122-000	50 mfd, 25 V. (Hi-Speed Cue)
C10	686-0001-000	.1 mfd, 500 V. (Hi-Speed Cue)
C11	686-0001-000	.1 mfd, 500 V. (Hi-Speed Cue)
C12	686-0001-000	.1 mfd, 500 V. (Hi-Speed Cue)
		DIODE
CR10	575-0007-000	1N4005
		FUSES
F1	417-0001-000	½ ampere, 3AG
F2	417-0002-000	1 ampere, slow-blow, 3AG
		LAMPS
I1	415-0002-000	Power Indicator, 110 V. (Not used in Hi-Speed Cue models)
I2	415-0001-000	No. 327, 28 V. (Run)
I3	415-0001-000	No. 327, 28 V. (Ready)
I4	415-0001-000	No. 327, 28 V. (Hi-Speed Cue)
		INTEGRATED CIRCUIT
IC1	605-0007-000	Regulated Power Supply, 24 VDC, 1 ampere, 7824KC, TO3
		SOCKETS
J1	380-0004-000	15 Pin (Control)
J2	380-0003-000	6 Pin (Audio)
J3	380-0001-000	3 Pin (Motor)
	380-0007-000	6 Pin (Motor—Hi-Speed Cue)
J4	380-0002-000	12 Pin Card Edge (Program)
J5	380-0002-000	12 Pin Card Edge (Cue)
J6	380-0008-000	18 Pin (WP Series—Interconnect)
		RELAYS
K1	480-0001-000	4 PDT, 24 V. (1 kHz)
K2	480-0001-000	4 PDT, 24 V. (150 Hz)
K3	480-0001-000	4 PDT, 24 V. (8 kHz)
K4	480-0001-000	4 PDT, 24 V. (Hi-Speed Cue)

Symbol	Part Number	Description
		INDUCTIVE DEVICES
L1	477-0006-002	Solenoid, 110 VDC
L2	504-0002-000	Head, Mono Reproduce, Nortronics, PB2H7KNO (2001)
	504-0004-000	Head, Stereo Reproduce, Nortronics, PB3Q7KNO (5701)
L3	504-0001-000	Head, Dummy, Nortronics
	504-0003-000	Head, Mono Record, Nortronics, PB2H4RNO (2003) (When used with a Recording Amplifier)
	504-0005-000	Head, Stereo Record, Nortronics, PB3Q4RNO (5703) (When used with a Recording Amplifier)
		RESISTORS
R11	626-0215-000	10 ohms, ½ watt, 5% (Hi-Speed Cue)
R12	626-0215-000	10 ohms, ½ watt, 5% (Hi-Speed Cue)
R13	626-0231-000	47 ohms, ½ watt, 5% (Hi-Speed Cue)
R14	626-0215-000	10 ohms, ½ watt, 5%
R15	626-0215-000	10 ohms, ½ watt, 5% (Hi-Speed Cue)
R16	626-0215-000	10 ohms, ½ watt, 5% (Hi-Speed Cue)
		SWITCHES
S1	392-0001-000	Micro (Cartridge Sensing)
S2	391-0002-000	Push-Button (Start)
S3	391-0002-000	Push-Button (Stop)
S4	391-0006-000	Push-Button (Hi-Speed Cue)
S5	392-0001-000	Micro (Cartridge Sensing—Motor)
		TRANSFORMERS
T1	526-0001-000	Power, SP Series
	526-0002-000	Power, WP Series
T2	532-0001-000	Audio, +14 dBm
T3	532-0001-000	Audio, +14 dBm (Stereo)
		MISCELLANEOUS
	311-0003-000	Strain Relief, AC Power Cord
	433-0001-000	Cord, AC Power
	418-0001-000	Holder, Fuse
	507-0001-010	Head Lead Assembly, Mono Play
	507-0002-010	Head Lead Assembly, Stereo Play Left
	507-0003-010	Head Lead Assembly, Stereo Play Cue
	507-0004-010	Head Lead Assembly, Stereo Play Right
	507-0001-000	Head Lead Assembly, Mono Record (WP Series)
	507-0002-000	Head Lead Assembly, Stereo Record Left (WP Series)
	507-0003-000	Head Lead Assembly, Stereo Record Cue (WP Series)
	507-0004-000	Head Lead Assembly, Stereo Record Right (WP Series)
	487-0001-000	Sockets, Relay
	613-0002-000	Socket, TO-3 Transistor (For IC1)
	378-0003-000	Plug, 15 Pin (Control)
	378-0002-000	Plug, 6 Pin (Audio)
	378-0001-000	Plug, 3 Pin (Motor)
	378-0007-000	Plug, 6 Pin (Motor—Hi-Speed Cue)

B. SP — UTILITY BOARD (831-0029-003) (w/Hi-Speed Cue—831-0029-023)

Symbol	Part Number	Description
		CAPACITORS
C13	696-0164-000	20 MF, 150 V.
	696-0155-000	2 MF, 150 V. (Hi-Speed Cue)
		DIODES
CR1	575-0007-000	1N4005
CR2	575-0007-000	1N4005
CR3	575-0007-000	1N4005
CR4	575-0007-000	1N4005
CR6	575-0007-000	1N4005
CR7	575-0007-000	1N4005
CR8	575-0007-000	1N4005
		RESISTORS
R1	628-0116-000	75 ohms, 5 watt, 5%
R3	626-0439-000	100 ohms, 1 watt, 10%
R4	626-0239-000	100 ohms, ½ watt, 5%
R5	626-0239-000	100 ohms, ½ watt, 5%
R6	626-0239-000	100 ohms, ½ watt, 5%
R7	626-0239-000	100 ohms, ½ watt, 5%
R9	628-0116-000	75 ohms, 5 watt, 5%
R17	626-0231-000	47 ohms, ½ watt, 5%

C. WP — UTILITY BOARD (831-0029-013) (w/Hi-Speed Cue—831-0029-033)

		CAPACITORS
C13	696-0164-000	20 MF, 150 V.
	696-0155-000	2 MF, 150 V. (Hi-Speed Cue)
		DIODES
CR1	575-0007-000	1N4005
CR2	575-0007-000	1N4005
CR3	575-0007-000	1N4005
CR4	575-0007-000	1N4005
CR6	575-0007-000	1N4005
CR7	575-0007-000	1N4005
CR8	575-0007-000	1N4005
CR9	575-0007-000	1N4005
		RESISTORS
R1	628-0116-000	75 ohms, 5 watt, 5%
R3	626-0439-000	100 ohms, 1 watt, 10%
R4	626-0239-000	100 ohms, ½ watt, 5%
R5	626-0239-000	100 ohms, ½ watt, 5%
R6	626-0239-000	100 ohms, ½ watt, 5%
R7	626-0239-000	100 ohms, ½ watt, 5%
R8	626-0231-000	47 ohms, ½ watt, 5% (WP Series)
R9	628-0116-000	75 ohms, 5 watt, 5%
R17	626-0231-000	47 ohms, ½ watt, 5%

D. PROGRAM REPRODUCE AMPLIFIER CARD

MONO 831-0027-003
STEREO 831-0027-013

		CAPACITORS
C101	696-0124-000	100 mfd, 25 V.
C102	696-0114-000	5 mfd, 25 V.
C103	677-0001-000	100 pfd, 300 V.
C104	681-0046-000	.01 mfd, 200 V.
C105	696-0114-000	5 mfd, 25 V.
C106	696-0124-000	100 mfd, 25 V.
C107	696-0117-000	10 mfd, 25 V.
C108	696-0117-000	10 mfd, 25 V.
C109	696-0117-000	10 mfd, 25 V.
C119	681-0032-000	.00068 mfd, 200 V.
C120	696-0202-000	450 mfd, 12 V.
C121	696-0114-000	5 mfd, 25 V.
C122	696-0122-000	50 mfd, 25 V.
C127	677-0001-000	100 pfd, 300 V.
C129	681-0050-000	.022 mfd, 200 V.
		CAPACITORS (STEREO ONLY)
C110	696-0124-000	100 mfd, 25 V.
C111	696-0114-000	5 mfd, 25 V.
C112	677-0001-000	100 pfd, 300 V.
C113	681-0046-000	.01 mfd, 200 V.
C114	696-0114-000	5 mfd, 25 V.
C115	696-0124-000	100 mfd, 25 V.
C116	696-0117-000	10 mfd, 25 V.
C117	696-0117-000	10 mfd, 25 V.
C118	696-0117-000	10 mfd, 25 V.
C123	681-0032-000	.00068 mfd, 200 V.
C124	696-0202-000	450 mfd, 12 V.
C125	696-0114-000	5 mfd, 25 V.
C126	696-0122-000	50 mfd, 25 V.
C128	677-0001-000	100 pfd, 300 V.
C130	681-0050-000	.022 mfd, 200 V.
		TRANSISTORS
Q101	590-0013-000	2N5089
Q102	590-0013-000	2N5089
Q103	590-0017-000	2N5816
Q104	590-0017-000	2N5816
		TRANSISTORS (STEREO ONLY)
Q105	590-0013-000	2N5089
Q106	590-0013-000	2N5089
Q107	590-0017-000	2N5816
Q108	590-0017-000	2N5816
		RESISTORS
R101	626-0311-000	100 K ohms, ½ watt, 5%
R102	630-0311-000	100 K ohms, ½ watt, 5%, Lo Noise
R103	630-0249-000	100 ohms, ½ watt, 5%, Lo Noise
R104	626-0275-000	3.3 K ohms, ½ watt, 5%
R105	636-0002-000	Variable, 10 K ohms, ¼ watt, (L. Equalization)
R106	630-0287-000	10 K ohms, ½ watt, 5%, Lo Noise
R107	630-0259-000	680 ohms, ½ watt, 5%, Lo Noise
R108	630-0283-000	6800 ohms, ½ watt, 5%, Lo Noise
R109	630-0267-000	1500 ohms, ½ watt, 5%, Lo Noise
R110	630-0295-000	22 K ohms, ½ watt, 5%, Lo Noise
	630-0293-000	18 K ohms, ½ watt, 5%, Lo Noise (STEREO ONLY)
R111	636-0002-000	Variable, 10 K ohms, ¼ watt, (L. Level)
R112	626-0307-000	68 K ohms, ½ watt, 5%
R113	626-0287-000	10 K ohms, ½ watt, 5%
R114	626-0271-000	2.2 K ohms, ½ watt, 5%
R115	626-0251-000	330 ohms, ½ watt, 5%
R116	626-0295-000	22 K ohms, ½ watt, 5%
R117	626-0279-000	4700 ohms, ½ watt, 5%
R118	626-0259-000	680 ohms, ½ watt, 5%
R119	626-0231-000	47 ohms, ½ watt, 5%
R139	626-0263-000	1 K ohms, ½ watt, 5%
R140	626-0271-000	2.2 K ohms, ½ watt, 5%
R141	626-0303-000	47 K ohms, ½ watt, 5%
R145	626-0267-000	1500 ohms, ½ watt, 5%

Symbol	Part Number	Description
		RESISTORS (STEREO ONLY)
R120	626-0311-000	100 K ohms, ½ watt, 5%
R121	630-0311-000	100 K ohms, ½ watt, 5%, Lo Noise
R122	630-0249-000	100 ohms, ½ watt, 5%, Lo Noise
R123	626-0275-000	3.3 K ohms, ½ watt, 5%
R124	636-0002-000	Variable, 10 K ohms, ¼ watt, (Right Equal)
R125	630-0287-000	10 K ohms, ½ watt, 5%, Lo Noise
R126	630-0259-000	680 ohms, ½ watt, 5%, Lo Noise
R127	630-0283-000	6800 ohms, ½ watt, 5%, Lo Noise
R128	630-0269-000	1800 ohms, ½ watt, 5%, Lo Noise
R129	630-0293-000	18 K ohms, ½ watt, 5%, Lo Noise
R130	636-0002-000	Variable, 10 K ohms, ¼ watt, (Right Level)
R131	626-0307-000	68 K ohms, ½ watt, 5%
R132	626-0287-000	10 K ohms, ½ watt, 5%
R133	626-0271-000	2.2 K ohms, ½ watt, 5%
R134	626-0251-000	330 ohms, ½ watt, 5%
R135	626-0295-000	22 K ohms, ½ watt, 5%
R136	626-0279-000	4700 ohms, ½ watt, 5%
R137	626-0259-000	680 ohms, ½ watt, 5%
R138	626-0231-000	47 ohms, ½ watt, 5%
R142	626-0231-000	1 K ohms, ½ watt, 5%
R143	626-0271-000	2.2 K ohms, ½ watt, 5%
R144	626-0303-000	47 K ohms, ½ watt, 5%
R146	626-0267-000	1500 ohms, ½ watt, 5%
		MISCELLANEOUS
IC101	606-0003-000	MFC 6040
IC102	606-0003-000	MFC 6040 (Stereo Only)
CR101	575-0007-000	IN4005
CR102	575-0007-000	IN4005 (Stereo Only)

E. CUE TONE DETECTOR CARD
1 TONE 831-0016-003
3 TONE 831-0016-013

		CAPACITORS
C205	696-0114-000	5 mfd, 25 V.
C206	696-0124-000	100 mfd, 25 V.
C207	696-0114-000	5 mfd, 25 V.
C208	681-0054-000	.047 mfd, 200 V.
C209		Selected to tune the detector to 1 kHz.
C210	696-0114-000	5 mfd, 25 V.
	681-0058-000	.1 mfd, 200 V. (Hi-Speed Cue)
C211	696-0114-000	5 mfd, 25 V. (8 kHz)
C212	696-0114-000	5 mfd, 25 V. (8 kHz)
C213	681-0081-000	.015 mfd, 200 V. (8 kHz)
C214		Selected to tune the detector to 8 kHz.
C215	696-0110-000	1 mfd, 25 V. (8 kHz)
C216	696-0114-000	5 mfd, 25 V. (150 Hz)
C217	696-0114-000	5 mfd, 25 V. (150 Hz)
C218	685-0003-000	2.2 mfd, 250 V. (150 Hz)
C219	696-0117-000	10 mfd, 25 V. (150 Hz)
C220	696-0114-000	5 mfd, 25 V. (1 kHz only) Single Tone
C221	686-0002-000	.025 mfd, 100 V.
C222	694-0002-000	10 mfd, 20 V.
C223	681-0046-000	.01 mfd, 200 V.
C224	694-0003-000	4.7 mfd, 35 V.
C225	694-0004-000	.47 mfd, 35 V.
C226	677-0001-000	100 pfd, 300 V.
C227	694-0002-000	10 mfd, 20 V.
		DIODES
CR201	575-0002-000	IN462
CR202	575-0002-000	IN462
CR203	575-0007-000	IN4005
CR204	575-0007-000	IN4005
CR205	575-0007-000	IN4005
CR206	575-0007-000	IN4005 (Three Tone Only)
CR207	575-0007-000	IN4005 (Three Tone Only)

Symbol	Part Number	Description
		INDUCTORS
L201	511-0002-000	Toroid, 500 mh
L202	511-0005-000	Toroid, 20 mh (8 kHz)
L203	511-0002-000	Toroid, 500 mh (150 Hz)
		TRANSISTORS
Q201	590-0001-000	2N3053
Q202	590-0014-000	2N2905
Q203	590-0001-000	2N3053
Q204	590-0001-000	2N3053 (8 kHz)
Q205	590-0014-000	2N2905
Q206	590-0001-000	2N3053 (8 kHz)
Q207	590-0001-000	2N3053 (150 Hz)
Q208	590-0014-000	2N2905 (150 Hz)
Q209	590-0001-000	2N3053 (150 Hz)
Q210	590-0011-000	2N930
Q211	590-0011-000	2N930
		RESISTORS
R202	626-0255-000	470 ohms, ½ watt, 5%
R203	626-0283-000	68 K ohms, ½ watt, 5%
R204	626-0239-000	100 ohms, ½ watt, 5%
R205	626-0263-000	1 K ohms, ½ watt, 5%
R206	636-0002-000	Variable, 10 K ohms, ¼ watt (1 kHz sensitivity)
R207	626-0291-000	15 K ohms, ½ watt, 5%
R208	626-0291-000	15 K ohms, ½ watt, 5%
R209	626-0275-000	3.3 K ohms, ½ watt, 5%
R210	626-0279-000	4.7 K ohms, ½ watt, 5%
R211	626-0271-000	2.2 K ohms, ½ watt, 5%
R212	626-0263-000	1 K ohms, ½ watt, 5%
R213	626-0279-000	4.7 K ohms, ½ watt, 5%
R214	626-0279-000	4.7 K ohms, ½ watt, 5%
R215	626-0448-000	240 ohms, 1 watt, 10%
R216	626-0291-000	15 K ohms, ½ watt, 5%
R217	636-0002-000	Variable, 10 K ohms, ¼ watt (8 kHz sensitivity)
R218	626-0291-000	15 K ohms, ½ watt, 5% (8 kHz)
R219	626-0291-000	15 K ohms, ½ watt, 5% (8 kHz)
R220	626-0275-000	3.3 K ohms, ½ watt, 5% (8 kHz)
R221	626-0279-000	4.7 K ohms, ½ watt, 5% (8 kHz)
R222	626-0271-000	2.2 K ohms, ½ watt, 5% (8 kHz)
R223	626-0263-000	1 K ohms, ½ watt, 5% (8 kHz)
R224	626-0279-000	4.7 ohms, ½ watt, 5% (8 kHz)
R225	626-0279-000	4.7 K ohms, ½ watt, 5% (8 kHz)
R226	626-0239-000	100 ohms, ½ watt, 5% (150 Hz)
R227	636-0002-000	Variable, 10 K ohms, ¼ watt (150 Hz sensitivity)
R228	626-0291-000	15 K ohms, ½ watt, 5% (150 Hz)
R229	626-0291-000	15 K ohms, ½ watt, 5% (150 Hz)
R230	626-0275-000	3.3 K ohms, ½ watt, 5% (150 Hz)
R231	626-0279-000	4.7 K ohms, ½ watt, 5% (150 Hz)
R232	626-0271-000	2.2 K ohms, ½ watt, 5% (150 Hz)
R233	626-0263-000	1 K ohms, ½ watt, 5% (150 Hz)
R234	626-0279-000	4.7 K ohms, ½ watt, 5% (150 Hz)
R235	626-0279-000	4.7 K ohms, ½ watt, 5% (150 Hz)
R236	626-0311-000	100 K ohms, ½ watt, 5%
R237	626-0235-000	68 ohms, ½ watt, 5%
R238	626-0287-000	10 K ohms, ½ watt, 5%
R239	626-0239-000	100 ohms, ½ watt, 5%
R240	626-0271-000	2.2 K ohms, ½ watt, 5%
R241	626-0259-000	680 ohms, ½ watt, 5%
R242	626-0271-000	2.2 K ohms, ½ watt, 5%
R243	626-0303-000	47 K ohms, ½ watt, 5%
R244	626-0287-000	10 K ohms, ½ watt, 5% (single tone only)

F. HIGH SPEED CUE DETECTOR CARD 831-0095-002

The parts listed in this section are used exclusively in the Hi-Speed Cue Detector Cards. Other parts are common to the Standard Cue Tone Detector Card and are listed in Section E.

CAPACITORS

C205	696-0110-000	1 MF, 25 V., Electrolytic
C207	694-0005-000	1 MF, 35 V., Tantalum
C210	694-0002-000	10 MF, 20 V., Tantalum
C220	677-0003-000	300 pf, 100 V., Mica
C221	681-0040-000	.0033 MF, 200 V., Mylar

RESISTORS

R205	626-0279-000	4.7 K ohms, ½ watt, 5%
R213	626-0303-000	47 K ohms, ½ watt, 5%
R236	626-0319-000	220 K ohms, ½ watt, 5%
R237	626-0233-000	56 ohms, ½ watt, 5%
R239	626-0235-000	68 ohms, ½ watt, 5%
R240	626-0261-000	820 ohms, ½ watt, 5%
R241	626-0251-000	330 ohms, ½ watt, 5%

TRANSISTORS

Q212	590-0017-000	2N5816

DIODES

CR208	577-0001-000	1N4742, 12 V., Zener
CR209	575-0007-000	1N4005
CR210	575-0007-000	1N4005

A. GENERAL

International Tapetronics has designed the reproducers and recorders with excellent reliability and minimum maintenance as primary design goals. Simplicity and mechanical strength are important factors in reducing mechanical maintenance. Electronic dependability is assured through the use of negative feedback and other techniques which stabilize circuits which are subjected to widely varying ambient conditions.

B. MECHANICAL MAINTENANCE— REPRODUCERS

1. Weekly Maintenance
   a. Clean the capstan and pressure roller with a cloth dipped in alcohol. Remove all traces of lubricant and oxide from both the capstan and pressure roller.
   b. Clean the head with a cotton swab dipped in a head cleaning solution.
2. Monthly Maintenance
   a. Check speed of unit. Since the capstan motor is a 450 RPM, direct drive, hysteresis synchronous device, there are no belts, pulleys, or flywheel assembly to cause speed variables. The bearings in this motor are permanently sealed ball bearings which need no lubrication. Any effort to lubricate the motor bearings will result in oil seeping into the motor windings.

      To check the speed of the unit, play test cartridge number 4 (see Section IX). the playing time should not vary more than .4 seconds in 3½ minutes. If a frequency counter is available, the 12 kHz tone should not vary more than 24 Hz (0.2%).

   b. Check the pressure roller using an ITC pressure roller gauge 830-0006-001 (see Section IV-D).
   c. Check head alignment (see Section IV-J).

C. MECHANICAL MAINTENANCE— RECORDERS

1. Clean the record head as described for the reproduce head.
2. Check head alignment as described for the reproduce head.

D. ELECTRICAL MAINTENANCE— REPRODUCERS

The electrical maintenance is to be conducted monthly and takes the form of measuring electrical parameters and making corrective adjustments if required.

Using the test cartridges and procedures outlined in Section VIII, check the reproducer cue sensitivity, program play level and equalization.

E. ELECTRICAL MAINTENANCE— RECORDERS

1. Head zenith adjustment should be conducted monthly for optimum performance of the recorder. This adjustment is described in Section IV-J.
2. The bias trap (L401) on the program amplifier printed circuit board should be checked monthly to obtain the overall response capabilities of the recorder. The adjustment is described in Section VII-2.
3. Record equalization as described in Section VII-3 should be checked monthly to assure the optimum response from the recorder.

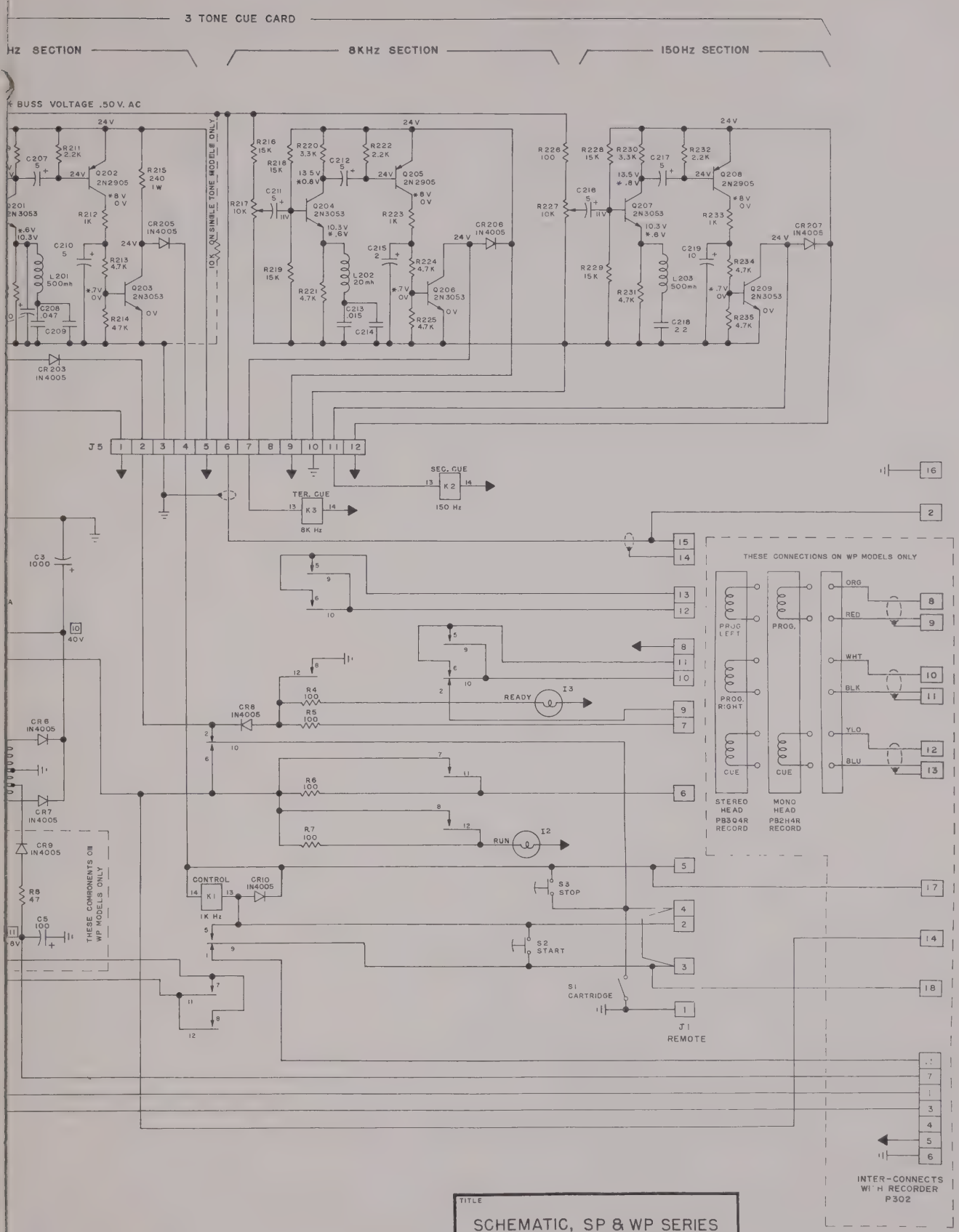
SECTION XIII

WARRANTY

International Tapetronics Corporation (ITC) warrants to Purchaser that the equipment sold is free of defects of workmanship or material and conforms to the specifications referred to or set out herein. This warranty, applying only to the original user, extends from date of shipment for a period of two years. No claim shall be maintained hereunder unless written notice is received by Seller within thirty days after the discovery of the facts giving rise to the claim. The sole or exclusive liability of Seller for breach of warranty shall be to refund the purchase price of the item sold, or at its option, to replace or repair the item or part concerned FOB its factory, or such other place as it may designate. ITC's liability shall arise only if Purchaser causes the defective part or item to be delivered to ITC for inspection upon ITC's request at Purchaser's expense. This warranty shall not be effective if the alleged defect is due to maltreatment, exposure, excessive moisture or any other use of the equipment other than the use for which the manufacturer prescribed.

No warranties expressed or implied shall be applicable to any equipment sold hereunder, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall International Tapetronics Corporation have any liability for consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of the products, or any inability to use them either separate or in combination with other equipment or materials, or from any other cause.

ITC's warranty is given solely to the original user and only to the extent above described. No dealer or agent is authorized to make any other or additional guaranty or warranty.



TITLE		
SCHEMATIC, SP & WP SERIES		
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILLINOIS 61701	893-0059-005	
	DRAWING NUMBER	REV.

3 TONE CUE CARD

EQUALIZED PRE AMP AND LIMITER

1KHz SECTION

8KHz SECTION

150Hz SECTION

BUSS VOLTAGE .50V. AC

STEREO REPRODUCE HEAD PB 307K

ORG
RED
WHT
BLK
YLO
BLU

TO LEFT PROGRAM AMP.
TO RIGHT PROGRAM AMP.
TO CUE AMP.

HEAD CABLE STEREO

MONO REPRODUCE HEAD PB 2H7K

ORG
RED
YLO
BLU

TO PROGRAM AMP.
TO CUE AMP.

HEAD CABLE MONO

NOTES:

1. ALL RESISTORS 1/2 W. UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS SHOWN IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. POWER LIGHT MAY BE REPLACED WITH POWER SWITCH - INSERT SWITCH AT POINT X.
4. NORMALLY WIRED FOR 600Ω OUTPUT - FOR 150Ω, REPLACE ORANGE WIRE WITH YELLOW WIRE
5. FUSE HOLDERS, RELAY, TRANSISTOR AND IC SOCKETS NOT SHOWN ON SCHEMATIC.
6. ALL POINTS MARKED → ARE CONNECTED TOGETHER AND ARE AT +25 V.
7. SWITCH IS JUMPERED AT FACTORY CUT FOR INTERRUPTED MOTOR OPERATION.

▲ C220 CAPACITOR USED ON 1K Hz CUE BOARDS ONLY.

8 VALUES OF COMPONENTS ARE TYPICAL. SCHEMATICS ARE INTENDED TO BE AS ACCURATE AS POSSIBLE. HOWEVER, AS NECESSARY, COMPONENTS ARE SUBSTITUTED WITH EQUIVALENT STANDARD VALUES, OR AS REQUIRED, TO INSURE PROPER OPERATION AND CALIBRATION

REGULATED V SUPPLY

LOW VOLTAGE REGULATOR IC1

ONE SINGLE TONE MODELS ONLY

THESE COMPONENTS ON WP MODELS ONLY

THESE CONNECTIONS ON WP MODELS ONLY

SEC. CUE

TER. CUE

8K Hz

150 Hz

1K Hz

READY

RUN

CONTROL

S1 CARTRIDGE

S2 START

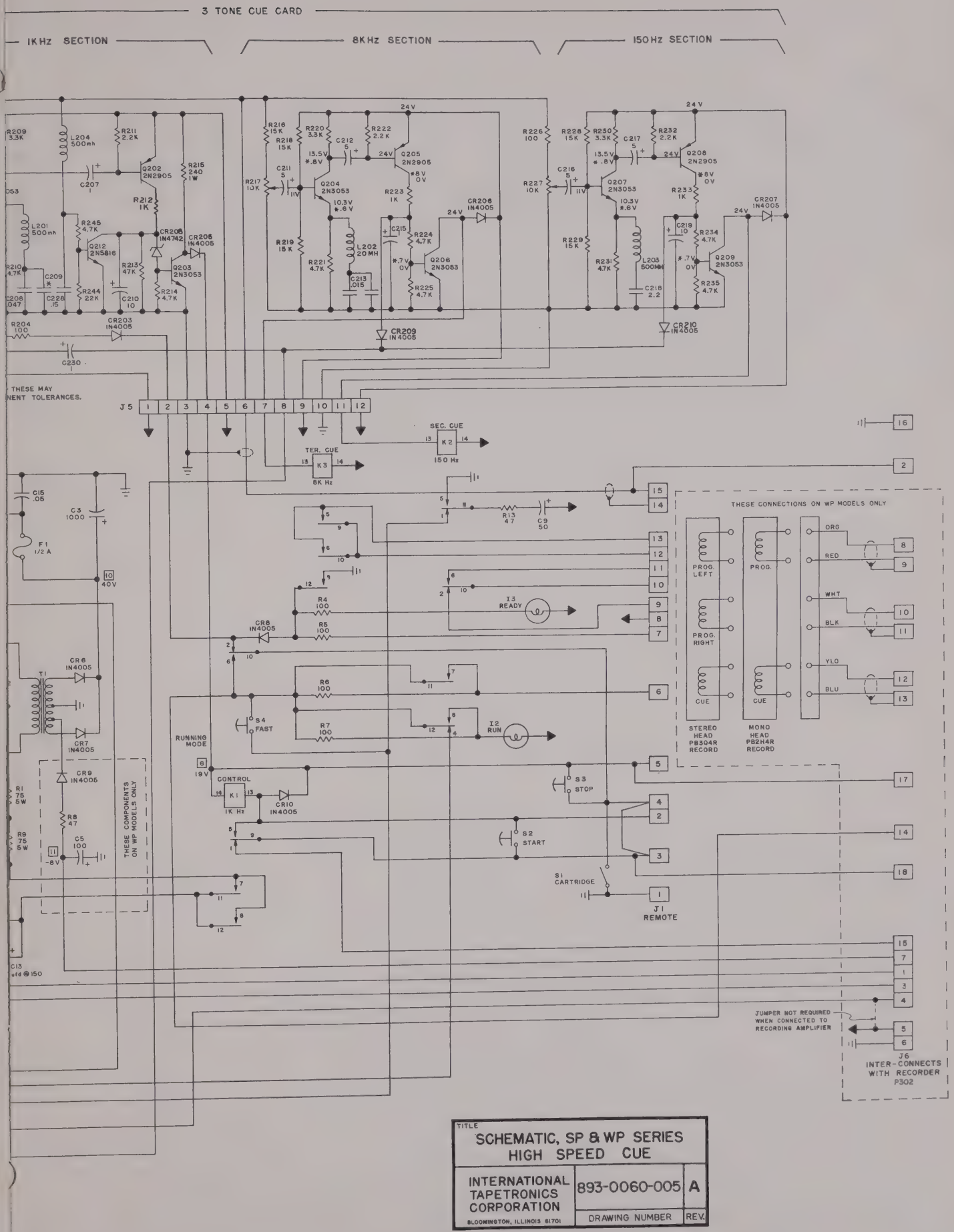
S3 STOP

S5 CARTRIDGE

J1 REMOTE

INTER-CONNECTS WITH RECORDER P302

TITLE	SCHEMATIC, SP & WP SERIES
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILLINOIS 61701	893-0059-005 DRAWING NUMBER — REV.



TITLE		
SCHEMATIC, SP & WP SERIES HIGH SPEED CUE		
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILLINOIS 61701	893-0060-005	A
	DRAWING NUMBER	REV.

3 TONE CUE CARD

EQUALIZED PRE-AMPLIFIER | 1KHZ SECTION | 8KHZ SECTION | 150HZ SECTION

STEREO REPRODUCE HEAD PB 307K

ORG — TO LEFT PROGRAM AMP.
RED
WHT — TO RIGHT PROGRAM AMP.
BLK
YLO — TO CUE AMP.
BLU

HEAD CABLE STEREO

MONO REPRODUCE HEAD PB 2H7K

ORG — TO PROGRAM AMP.
RED
YLO — TO CUE AMP.
BLU

HEAD CABLE MONO

* NOMINAL VALUES ONLY – THESE MAY CHANGE DUE TO COMPONENT TOLERANCES.

NOTES:
1. ALL RESISTORS ½W. UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS SHOWN IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. POWER LIGHT MAY BE REPLACED WITH POWER SWITCH – INSERT SWITCH AT POINT X.
4. NORMALLY WIRED FOR 600 Ω OUTPUT – FOR 150 Ω, REPLACE ORANGE WIRE WITH YELLOW WIRE.
5. FUSE HOLDERS, RELAY, TRANSISTOR AND IC SOCKETS NOT SHOWN ON SCHEMATIC.
6. ALL POINTS MARKED → ARE CONNECTED TOGETHER AND ARE AT +25 V
7. SWITCH IS JUMPERED AT FACTORY. CUT FOR INTERRUPTED MOTOR OPERATION
8. VALUES OF COMPONENTS ARE TYPICAL. SCHEMATICS ARE INTENDED TO BE AS ACCURATE AS POSSIBLE. HOWEVER, AS NECESSARY, COMPONENTS ARE SUBSTITUTED.

THESE CONNECTIONS ON WP MODELS ONLY

STEREO HEAD PB304R RECORD — MONO HEAD PB2H4R RECORD

JUMPER NOT REQUIRED WHEN CONNECTED TO RECORDING AMPLIFIER

J8 INTER-CONNECTS WITH RECORDER P302

THESE COMPONENTS ON WP MODELS ONLY

TITLE		
SCHEMATIC, SP & WP SERIES HIGH SPEED CUE		
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILLINOIS 61701	893-0060-005	A
	DRAWING NUMBER	REV.

TECHNICAL SERVICE INFORMATION

TO: All ITC Customers
(Please forward to Engineering Department)

RE: Returned Equipment and Components Policy

Dear Chief Engineer:

ITC's objective is to offer the best possible service to our customers. This objective carries through to any equipment that is returned for service--whether it's under warranty or being charged to the customer. Occasionally, however, we've found that our ability to provide this high caliber of service is hampered by our receipt of assemblies and machines without the customer's prior contact with ITC. Special procedures have been developed to allow expedient repair of customer returned items. However, our system only works when we have been notified by the customer that an item will be returned.

Here's how you can help:

1. If a problem is encountered with an ITC machine, call our Technical Service Department collect, at 309-828-1381. Most often, the problem can be diagnosed over the telephone and the necessary replacement part(s) can be shipped. . .often the same day. In most cases, this is the fastest and least expensive method of making the repair for both the customer and ITC.

2. If the problem can't be remedied via telephone conversations, ITC will gladly repair the defective item and return it to you. All we require is notification from you that the item will be returned.

INTERNATIONAL TAPETRONICS CORPORATION
2425 SOUTH MAIN STREET • BLOOMINGTON, ILLINOIS 61701
TELEPHONE: 309-828-1381

3. When returning an item or machine for repair, please take a moment to:

   A. Write a note and describe the problem as fully as possible.

   B. Be sure to include on the list your name, call letters or company name, and phone number.

4. Package the item securely! Often we receive items that have sustained shipping damage. Occasionally, the damage is sufficiently extensive as to prohibit repair. ITC is not liable for shipping damage. Also, we strongly recommend that complete machines be returned in their original packing material. If you don't have the proper shipping materials, ITC can supply them. It takes longer but it is better to be safe than sorry. Remember--you are responsible for shipping damage.

5. Return the machine with prepaid shipping via your choice of transportation. If necessary, ITC will offer suggestions on methods of shipment.

6. It is an excellent idea to insure the parcel. Declared value can be obtained from the appropriate ITC price list.

It is our sincere hope that you will assist us in this matter. When an item is returned without our prior knowledge, every customer suffers.

Thank you for your cooperation.

TECHNICAL SERVICE INFORMATION

TO: Chief Engineer

MACHINE: All ITC Tape Machines

REASON: Capstan Motor Rebuilding Program

In an effort to provide continuing service to our customers, ITC has recently initiated a Capstan Motor Rebuilding Program. This program was implemented to offer customers an economical alternative when faced with a capstan motor failure past ITC's two year warranty period.

To simplify the charges for motor rebuilding, and to expedite a customer's request for a rebuilt motor, ITC has adopted a "flat rate" repair charge. The rate schedule is shown on page 2. The customer will be charged one of two rates based on whether or not a comparable motor is exchanged for a rebuilt motor. However, there are two exclusions to the "Exchange" rate schedule:

1. The motor returned to ITC must be repairable. No motors with shorted or open windings or other electrical defects shall be considered repairable. ITC shall have the sole and final responsibility of determining if the motor will be accepted for exchange.

2. Only Japan Servo motors (marketed by JPC) will be considered a comparable motor. These motors can be readily identified by their BLACK rotor and bell housing.

All rebuilt capstan motors carry a limited 90 day warranty and are guaranteed to meet the electrical and mechanical performance specifications of a new motor.

To arrange the purchase of a rebuilt capstan motor, contact International Tapetronics Corporation, collect, at 309-828-1381.

INTERNATIONAL TAPETRONICS CORPORATION
2425 SOUTH MAIN STREET • BLOOMINGTON, ILLINOIS 61701
TELEPHONE: 309-828-1381

ITC REBUILT CAPSTAN MOTORS

Part Number	Description	Exchange	Outright
451-0053-120	Rebuilt Motor, Capstan with plug (60Hz/117VAC) for SP/RP/WP (SA1-2A)	$100	$150
451-0003-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) for 3D models only (SA1-3A)	$155	$205
451-0005-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) for 7 1/2-30 IPS Hi-Speed Cue SP/WP/RP models only (SA1-4A)	$130	$180
451-0053-130	Rebuilt Motor, Capstan with Wiring Terminals (60Hz/117VAC) For PD-II (SA1-2A)	$100	$150
451-0053-140	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) 7 1/2 IPS for 750 (SA1-2A)	$100	$150
451-0058-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) 3 3/4-7 1/2 IPS for 750 (SA1-6A)	$165	$215
451-0059-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) 7 1/2-15 IPS for 750 (SA1-5A)	$165	$215
451-0036-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) 3 3/4-7 1/2 IPS for 850 (SA1-8A)	$190	$240
451-0035-120	Rebuilt Motor, Capstan with Plug (60Hz/117VAC) 7 1/2-15 IPS for 850 (SA1-7A)	$190	$240

2425 South Main
Post Office Box 241
Bloomington, Illinois 61701

INTERNATIONAL TAPETRONICS CORPORATION

January 1, 1979
Telephone: 309-828-1381

MAINTENANCE PARTS PRICE LIST
SP, WP, & 3D SERIES REPRODUCERS
RP SERIES RECORDER/REPRODUCERS
RA & WRA SERIES RECORDING AMPLIFIERS

ITEM NO.	PART NUMBER	DESCRIPTION	PRICE
ELECTRONIC PARTS			
1	391-0002-000	Switch, Pushbutton (Dialco - 513-0110-001)-lens not included, see items 4-9	$ 7.90
2	391-0003-000	Switch, Pushbutton, "STOP" (Red - for 3D models only	2.10
3	392-0001-000	Switch, Snap (Micro - V3L1183-D8)	1.75
4	404-0006-000	Lens, Yellow (Dialco - 303-3476)	1.70
5	404-0007-000	Lens, Green (Dialco - 303-3472)	1.70
6	404-0007-010	Lens, Green, engraved "START"	2.50
7	404-0008-010	Lens, Red, engraved "REC"	2.50
8	404-0009-010	Lens, Blue, engraved "SEC"	2.50
9	404-0010-010	Lens, White, engraved "TER"	2.50
10	415-0001-000	Lamp, Switch, #327 (for Dialco)	.65
11	415-0002-000	Lamp, Power Indicator Assy, 110 VAC (Leecraft 32-1311T)	2.50
12	504-0001-000	Head, Dummy	2.00
13	504-0002-000	Head, Monophonic, (Two Channel) Reproduce (Nortronics LP-B2H7k)	40.00
14	504-0003-000	Head, Monophonic, (Two Channel) Record (Nortronics LP-B2H4R)	40.00
15	504-0004-000	Head, Stereophonic, (Three Channel) Reproducer (Nortronics LP-B3Q7K)	120.00
16	504-0005-000	Head, Stereophonic, (Three Channel) Record (Nortronics LP-B3Q4R)	120.00
17	504-0011-000	Head, Erase/Record, (Two Channel) (Nortronics PA2H44R) - for program delay models only	65.00
18	507-0001-010	Cable, Head SP/WP/RP Mono Play	6.50
19	507-0001-000	Cable, Head RP/3D Mono Record	6.50

JA/LC/11-22-78

20	507-0001-020	Cable, Head 3D Mono Play	6.50
21	507-0002-010	Cable, Head SP/WP Stereo Play (Left Channel)	5.10
22	507-0003-010	Cable, Head SP/WP Stereo Play (Right Channel)	5.10
23	507-0004-010	Cable, Head SP/WP Stereo Play (Cue	5.10
24	507-0002-000	Cable, Head RP Stereo Record (Left Channel)	5.10
25	507-0004-000	Cable, Head RP Stereo Record (Right Channel)	5.10
26	507-0003-000	Cable, Head RP Stereo Record (Cue)	5.10
27	507-0002-020	Cable, Head 3D Stereo Play (Left Channel)	6.50
28	507-0004-020	Cable, Head 3D Stereo Play (Right Channel)	6.50
29	507-0003-020	Cable, Head 3D Stereo Play (Cue)	6.50
30	507-0002-030	Cable, Head 3D Stereo Record (Left channel)	5.10
31	507-0004-030	Cable, Head 3D Stereo Record (Right Channel)	5.10
32	507-0003-030	Cable, Head 3D Stereo Record (Cue)	5.10
33	554-0002-000	Meter, VU Scale (Modutec)	26.40
34	575-0001-000	Diode, 1N295	.65
35	575-0007-000	Diode, IN4005 (replaces all diodes except IN462 & IN295)	.65
36	581-0001-000	SCR, 2N5061 (replaces C6F and MC1906-2)	.75
37	590-0001-000	Transistor, NPN 2N3053	.75
38	590-0013-000	Transistor, NPN 2N5089	.50
39	590-0014-000	Transistor, NPN 2N2905	.75
40	590-0011-000	Transistor, NPN 2N930	.60
41	590-0017-000	Transistor, NPN 2N5816	.60
42	590-0018-000	Transistor, PNP 2N5817	.60
43	601-0001-000	Transistor, Unijunction, 2N4870	1.30
44	605-0007-000	IC, Series Voltage Regulator (7824KCT03)	4.95
45	650-0003-000	LDR, SIGMA 301-T1-12B1	2.50
46	480-0001-000	Relay, 4 PDT, 24 VDC	7.40
47	698-0001-000	Capacitor, 1000 MFD 50 V CAN	2.75
48	698-0003-000	Capacitor, DUAL 100 MFD 250 VDC CAN	2.85
49	698-0004-000	Capacitor, DUAL 1000 MFD 50 VDC CAN	4.05
50	683-0001-000	Capacitor, Motor Capstan, 1.5 MFD 370 VAC	3.30
51	683-0003-000	Capacitor, Motor Capstan, 2.0 MFD 370 VAC	5.85

PC CARDS

1	831-0029-003	PC Card, SP Utility Power Supply	17.20
2	831-0094-003	PC Card, Program Reproduce Amplifier, Mono, +18 dBm	45.90
3	831-0094-013	PC Card, Program Reproduce Amplifier, Stereo +18 dBm	79.00
4	831-0016-003	PC Card, Single Tone Cue Detector, 1 kHz	54.75
5	831-0016-013	PC Card, Three Tone Cue Detector, 1 kHz, 150 Hz & 8 kHz	102.85
6	831-0095-003	PC Card, Hi-Speed Cue Tone Detector, 1 kHz, 150 Hz & 8 kHz	118.75
7	831-0029-013	PC Card, WP Utility Power Supply	20.00
8	831-0069-003	PC Card, Recording Amplifier, Monophonic	57.55
9	831-0069-013	PC Card, Recording Amplifier, Stereophonic	98.40
10	831-0006-003	PC Card, Cue Oscillator, 1 kHz	40.50
11	831-0006-013	PC Card, Cue Oscillator, 1 kHz, 150 Hz & 8 kHz	72.00
12	831-0007-003	PC Card, Bias Oscillator, Monophonic	48.00
13	831-0007-013	PC Card, Bias Oscillator, Stereophonic	56.60
14	831-0106-013	PC Card, Recorder Control	48.90
15	831-0106-003	PC Card, Recorder Control, hi-speed cue models only	57.15
16	831-0009-003	PC Card, Meter Switch, Monophonic	24.00
17	831-0009-013	PC Card, Meter Switch, Stereophonic	28.95
18	831-0072-023	PC Card, Audio Input Pad, Monophonic	27.70
19	831-0072-033	PC Card, Audio Input Pad, Stereophonic	41.00
20	831-0030-003	PC Card, 3D Utility Power supply	35.90
21	831-0012-003	PC Card, 12 Conductor Test Extender	14.00
22	831-0013-003	PC Card, 15 Conductor Test Extender	14.00
23	831-0014-003	PC Card, 18 Conductor Test Extender	15.00
24	831-0044-003	PC Card, IGM Cue Tone Detector	115.00
25	831-0021-003	PC Card, IGM Recorder Control	55.00

MECHANICAL PARTS

1	258-0003-001	Case, SP Series, complete	32.00
2	258-0006-001	Case, WP & RP Series, complete	39.00
3	272-0001-001	Guide, Cartridge (either left or right)	.50
4	272-0002-002	Guide, Tape (right and center)	1.25
5	272-0003-001	Guide, Tape (left)	1.50
6	282-0001-001	Pin, Roll (solenoid chain connector)	.25
7	878-0008-000	Level Control Extender Shaft and Knob	4.00

8	284-0001-000	Plug, Hole (recording amplifier input level)	.25
9	301-0001-011	Spring, Cartridge Hold-Down	1.05
10	301-0004-011	Spring, Cartridge Hold-Down for 3D top deck only	1.05
11	301-0005-000	Spring, Solenoid Return (for round solenoid)	.25
12	451-0053-020	Motor, Capstan with Plug (60 Hz, 117 VAC) - for SP/WP/RP models only (SA1-2A)	230.00
13	451-0003-020	Motor, Capstan with Plug, (60 Hz, 117 VAC) - for 3D models only (SA1-3A)	285.00
14	451-0005-020	Motor, Capstan with Plug (60 Hz, 117 VAC) - for 7 1/2 - 30 IPS hi-speed cue SP/WP/RP models only (SA1-4A)	265.00
15	830-0003-001	Gauge, Tape Height	16.00
16	830-0006-001	Gauge, Pressure Roller Pressure	7.50
17	830-0007-001	Gauge, Shaft Locater	22.00
18	477-0006-002	Solenoid, Assy with Plunger (front mount)	36.00
19	832-0001-000	Solenoid Clevis Assy with Chain	9.45
20	297-0004-001	Shield, Head Hum	3.00
21	251-0018-001	Bearing, 3D Series Top Capstan (SA)	25.00
22	253-0045-001	Block, 3D Series Top Capstan	7.00

KITS/MISCELLANEOUS PARTS

1	878-0026-000	Lamp, Cartridge 28 V, Yellow, "READY", Clip & Washer (3D Series only)	3.50
2	878-0012-000	Pressure Roller Replacement Kit (includes clip & washers)	5.20
3	878-0010-000	150 Hz Cue Tone Detector Parts Kit	29.50
4	878-0011-000	150 Hz Cue Tone Oscillator Parts Kit	15.00
5	878-0048-000	8 kHz Cue Tone Detector Parts Kit	29.50
6	878-0049-000	8 kHz Cue Tone Oscillator Parts Kit	15.00
7	878-0013-000	Gauge Kit, Tape Height, Pressure Roller Pressure, Capstan Shaft Locater	40.00
8	177-0046-000	Wrench, Allen 7/64" (for 3D Series front panel & pressure roller cross-shaft clamp screws)	.25
9	860-0001-000	Switcher, Audio - 3 channel (mono or stereo)	140.00
10	830-0009-010	Auxiliary Start Pulse Circuit	10.50
11	878-0009-000	Audio Mixing Circuit, Three Input/Single Output	20.00
12	878-0041-000	Test Extender Kit for SP/RP/WP/3D/WRA (includes 3 PC cards)	40.00

13	878-0043-000	Kit for Stereophonic Conversion of SP/WP Series mono machine -- play only	230.00
14	878-0055-003	Program Amplifier Mono Replaces 831-0027-003	45.90
15	878-0055-013	Program Amplifier, Stereo, Replaces 831-0027-013	79.00
16	878-0044-000	Kit for Stereophonic conversion of 3D Series mono machine	690.00
17	878-0031-000	IC Series Regulator Replacement Kit (replaces 605-0001-000 with a 605-0007-000)	9.00
18	878-0042-000	3D Series Top Capstan Bearing Kit with block (SA)	32.00
19	432-0001-000	Cable, Three Deck to WRA Recording Amplifier	65.00
20	378-0002-000	Plug, Cable, 6 pin male (audio output)	1.75
21	378-0003-000	Plug, Cable, 15 pin male (Reproduce remote)	2.95
22	378-0004-000	Plug, Cable, 18 pin male (Recorder remote)	3.00
23	380-0009-000	Socket, Cable, 6 pin female (Recorder audio)	1.95
24	890-0001-000	Book, Instruction SP/WP	5.00
25	890-0002-000	Book, Instruction RA/WRA	4.00
26	890-0004-000	Book, Instruction 3D	5.00
27	890-0009-000	Book, Instruction RP	5.00

All prices are subject to change without notice.

The above price list is provided for our customers' convenience, as those commonly used parts are readily available from our parts stock for maintenance and repair. Because our selling price is based on actual costs, you may find some items can be purchased at a lower cost from an electronics house than from International Tapetronics Corporation.

All pricing above is U.S. Domestic only. Prices will vary outside of U.S. Territory.

Minimum Order: $15.00

LC/JA/11-22-78

ADDENDUM

PROGRAM REPRODUCE AMPLIFIER
FOR
SP, WP, RP, RPD, & 3D MACHINES

831-0094-003 (Mono)
831-0094-013 (Stereo)

General Description

The Program Reproduce Amplifier shown in the Technical Manual has been replaced with a new amplifier circuit bearing ITC part number 831-0094-003 (mono) or 831-0094-013 (stereo). The new amplifier offers improved sonic performance, passive squelching and increased reliability.

All interconnect wiring to the 831-0094 printed circuit board (via J4) remains as represented in the Technical Manual. However, one jumper wire has been added from the Program Reproduce Amplifier edge connector, J4, Pin 3 to the Detector card edge connector, J5, Pin 5. This jumper supplies 24 volts to the squelch devices (LDR 101 and LDR 102) on the Program Reproduce Amplifier P.C. card.

Circuit Description

The 831-0094-003 (mono) and 831-0094-013 (stereo) Program Reproduce Amplifiers are provided to amplify and contour the signal supplied by the reproduce tape head.

On stereo units the Left Channel and Right Channel are identical. Therefore, the description on the following page references components in the Left Channel Only.

INTERNATIONAL TAPETRONICS CORPORATION
2425 SOUTH MAIN STREET • BLOOMINGTON, ILLINOIS 61701
TELEPHONE: 309-828-1381

The input signal is coupled from the reproduce tape head to the first stage via coupling capacitor C102. Transistors Q101 and Q102 serve as a pre-amplifier which is stabilized to prevent performance variations. DC Feedback is supplied to the base of Q101 from the emitter of Q102 via R101, R107, and R108. AC feedback from the collector of Q102 to the emitter of Q101 (C105, R105, and R104) determines the frequency response of the amplifier. Variable "equalization" is provided by potentiometer R105. C103 and C104 are included for high frequency (RF) rejection.

The output of the pre-amplifier is AC coupled (C107) to the Light Dependent Resistor, LDR 101, which functions as a squelching device. LDR 101 and R113 form a signal voltage divider circuit. The resistance of LDR 101 is controlled by the internal lamp element's brilliance. In this application, the lamp is either fully "on" or "off" as determined by relay K1. With the deck in the run mode, a ground path is supplied to LDR 101 via contacts 6 and 10 of relay K1. Hence, the resistance element of LDR 101 exhibits minimum resistance and the potential across R113 is at its maximum value.

Signal from R113 is again AC coupled (C108) to the base of Q103, a common emitter amplifier stage, with the biasing resistor, R114, connected between the collector and base for DC and temperature stability. The collector output of Q103 is AC coupled (C109) to the base of driver transistor Q104. Q104 supplies drive current for complimentary amplifiers Q105 and Q106. Transistors Q104, Q105, and Q106 are direct coupled with local feedback provided by R119. The output stage (Q105 and Q106) is AC coupled (C111) to Pin 2 of J4.

PARTS LIST

831-0094-003 (Mono)
831-0094-013 (Stereo)

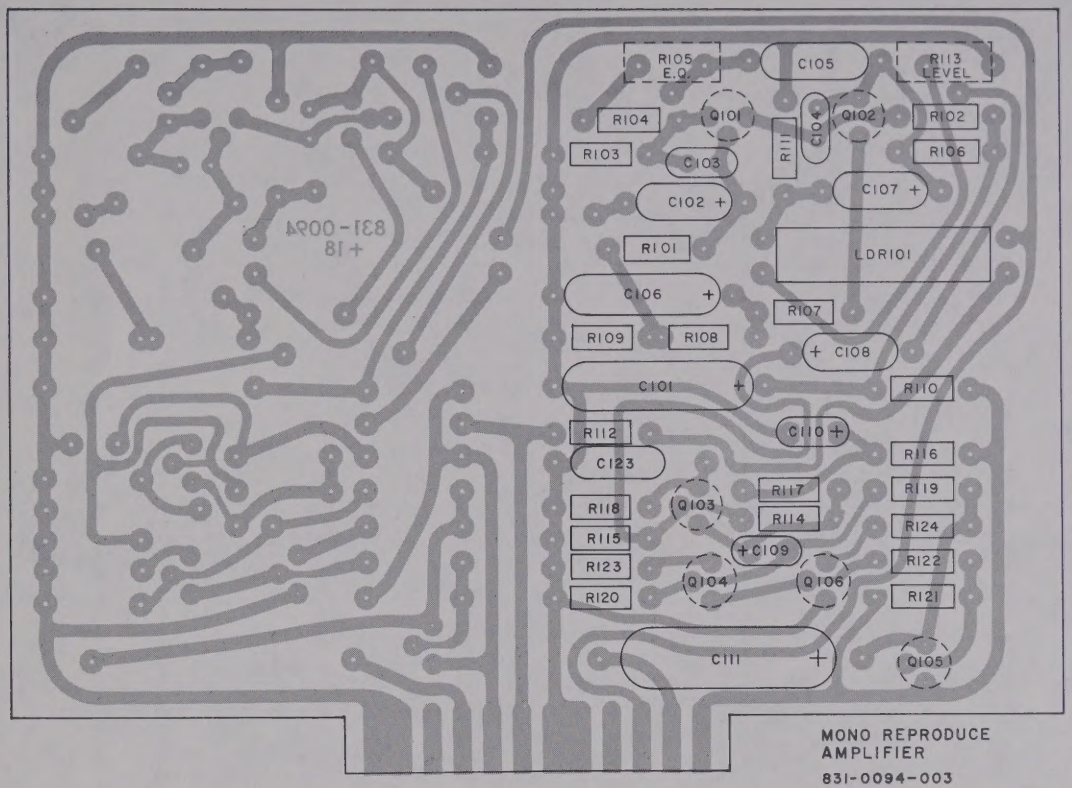
Component (LC-RC)	ITC Part Number	Description
R101, R129	630-0311-000	Resistor, 100K ohm 1/2 watt 5%
R102, R125	630-0303-000	Resistor, 47K ohm 1/2 watt 5%
R103, R126	630-0247-000	Resistor, 220 ohm 1/2 watt 5%
R104, R127	630-0269-000	Resistor, 1.8K ohm 1/2 watt 5%
R105, R128	636-0002-000	Potentiometer, 10K ohm 1/4 watt
R113, R137	"	"
R106, R130	630-0271-000	Resistor, 2.2K ohm 1/2 watt 5%
R117, R141	"	"
R121, R145	"	"
R107, R131	630-0251-000	Resistor, 330 ohm 1/2 watt 5%
R118, R142	"	"
R108, R132	630-0267-000	Resistor, 1.5K ohm 1/2 watt 5%
R109, R133	630-0255-000	Resistor, 470 ohm 1/2 watt 5%
R110, R134	630-0285-000	Resistor, 8.2K ohm 1/2 watt 5%
R111, R135	630-0295-000	Resistor, 22K ohm 1/2 watt 5%
R120, R144	"	"
R112, R136	630-0258-000	Resistor, 620 ohm 1/2 watt 5%
R114, R138	630-0307-000	Resistor, 68K ohm 1/2 watt 5%
R115, R139	630-0287-000	Resistor, 10K ohm 1/2 watt 5%
R116, R140	"	"
R119, R143	630-0315-000	Resistor, 150K ohm 1/2 watt 5%
R122, R146	630-0252-000	Resistor, 360 ohm 1/2 watt 5%
R123, R147	630-0231-000	Resistor, 47 ohm 1/2 watt 5%
R124, R148	630-0223-000	Resistor, 22 ohm 1/2 watt 5%
C101, C112	696-0124-000	Capacitor, Electrolytic 100MFD, 25V
C102, C113	696-0114-000	Capacitor, Electrolytic 5MFD, 25V
C107, C118	"	"
C108, C119	"	"
C103, C114	677-0001-000	Capacitor, Silver Mica 100PFD 300V
C104, C115	"	"
C105, C116	681-0048-000	Capacitor, Paper .015 MFD 200V
C106, C117	696-0078-000	Capacitor, Electrolytic 100 MFD 12V
C109, C120	694-0003-000	Capacitor, Tantalum 4.7 MFD 35V
C110, C121	694-0007-000	Capacitor, Tantalum 47 MFD 20V
C111, C122	696-0201-000	Capacitor, Electrolytic 220 MFD 25V
C123, C124	681-0050-000	Capacitor, Paper .022 MFD 200V

PARTS LIST (cont.)

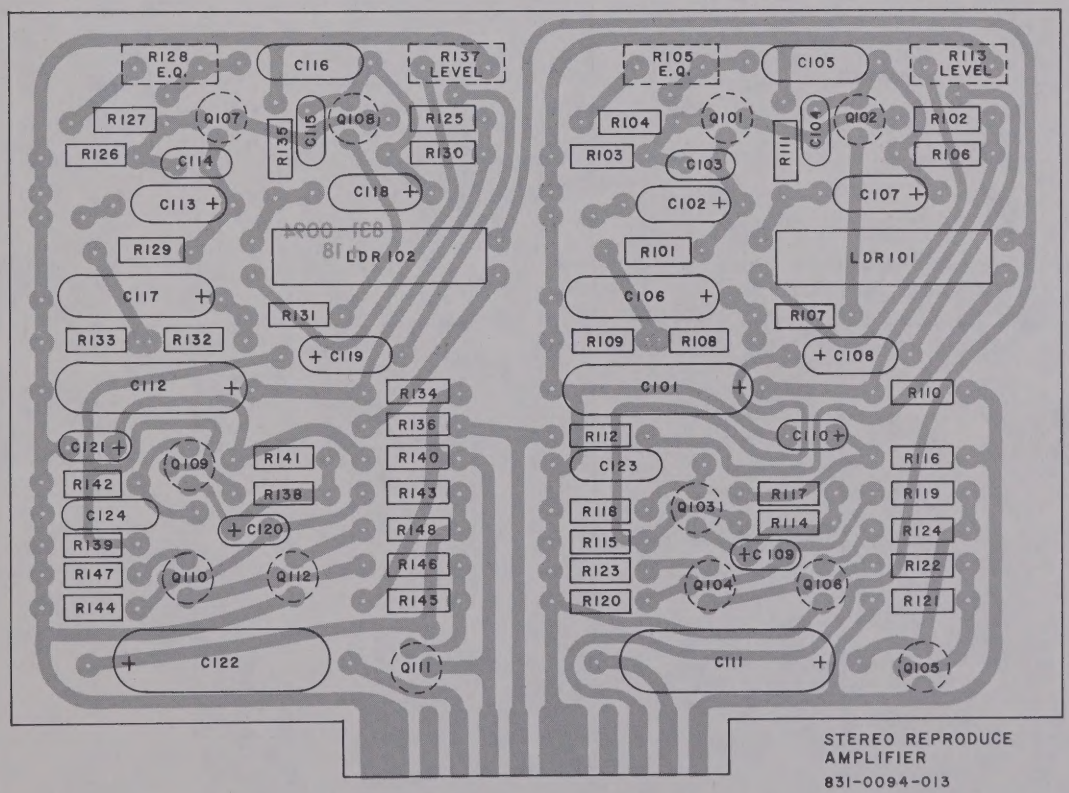
Component	ITC Part Number	Description
Q101, Q107	590-0013-000	Transistor, 2N5089
Q102, Q108	"	"
Q103, Q109	590-0017-000	Transistor, 2N5816
Q104, Q110	"	"
Q105, Q111	"	"
Q106, Q112	590-0018-000	Transistor, 2N5817
LDR101	650-0003-000	LDR, Sigma, 301-T1-12B1
LDR102	"	"

Miscellaneous Parts

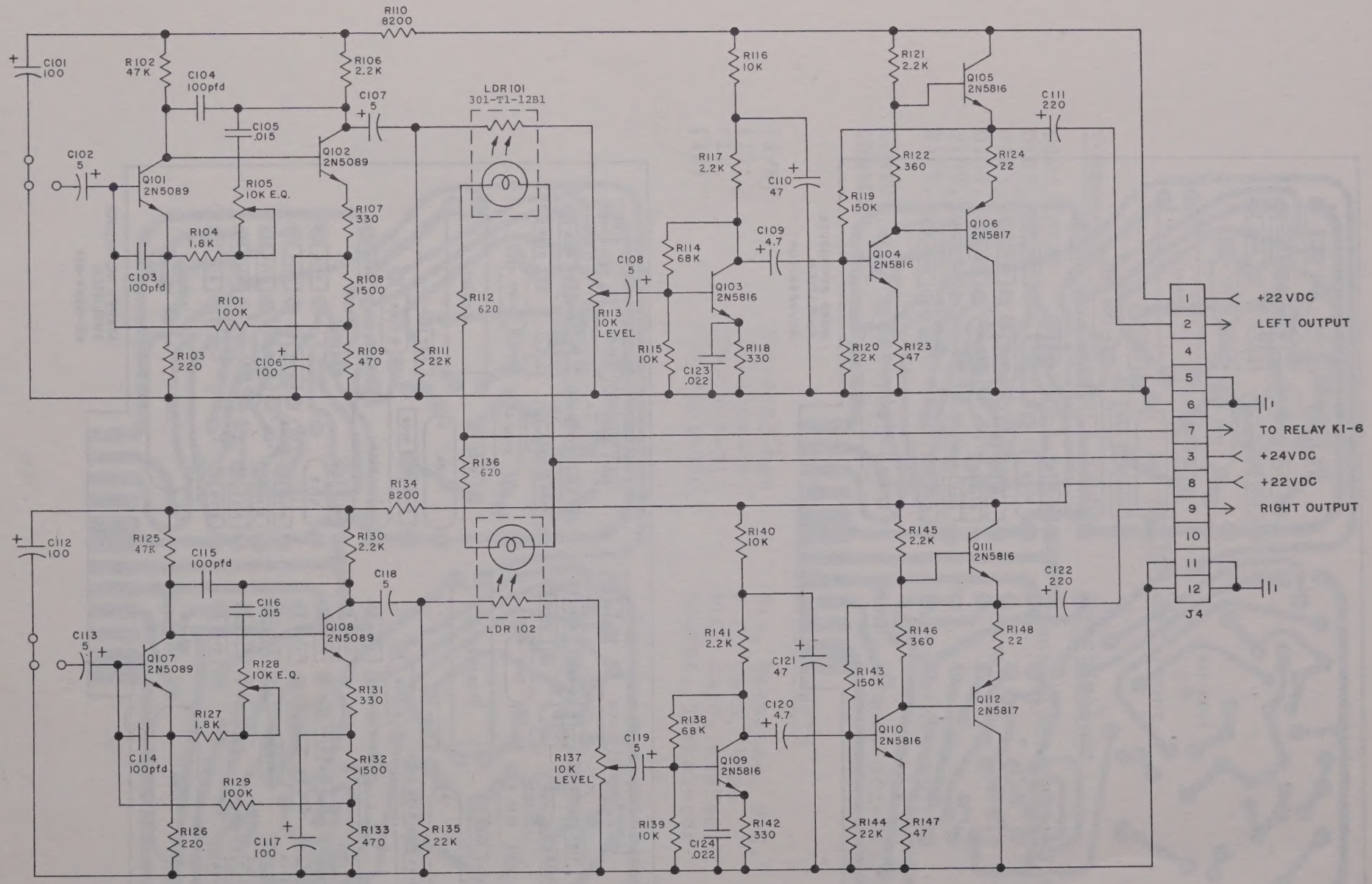
(3/6)	282-0002-000	Pin, Terminal, P.C.
(1)	325-0094-003	P.C. Card, Mono
(1)	325-0094-013	P.C. Card, Stereo
(12)	613-0001-000	Socket, Transistor



MONO REPRODUCE AMPLIFIER
831-0094-003



STEREO REPRODUCE AMPLIFIER
831-0094-013



09/11/78LC

6

811-0055-001

TITLE	SCHEMATIC - SP, WP, 3D +18dBm REPRODUCE AMP.
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILL. 61701	893-0064-003
	DRAWING NUMBER
	REV.